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Tramadol and Dexmedetomidine in the Treatment of Shivering Following Spinal Anesthesia

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Abstract

Introduction: It is imperative for an anaesthetist to know the adverse effects of shivering and hypothermia on human body which may occur when the patients are under anesthesia, so that timely treatment can be provided. *Aim:* To compare tramadol and dexmedetomidine in the treatment of shivering after spinal anesthesia. *Materials and Methods:* This was a randomized, prospective study in which 80 patients posted for elective surgeries given spinal anesthesia who developed shivering were included in the study. *Results:* The incidence of shivering was 40% in our study. The difference in the time interval between administration of drug after the onset of shivering and cessation of shivering was significantly shorter in the dexmedetomidine group when compared to the tramadol group. Changes in Heart rate, body temperature, mean blood pressure are not significant in our study in both groups. Nausea and vomiting observed in tramadol group, and not in the dexmedetomidine group. *Conclusion:* Dexmedetomidine can be a substituent to tramadol for cessation of post spinal anesthesia shivering.

Keywords: Shivering; Dexmedetomidine; Tramadol.

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Introduction

Shivering is response of body to hypothermia in order to increase the heat production. The primary causes of shivering in intra and postoperative periods are heat loss, pain, and systemic release of pyrogens or increased sympathetic tone. Spinal anaesthesia impairs the thermoregulation system by inhibition of tonic vasoconstriction, which plays an important role in thermoregulation. These factors precipitate hypothermia and shivering in patients. It is important as anaesthesiologists to know the adverse effects of hypothermia [1].

Various pharmacologic and nonpharmacologic modalities are available for treatment of shivering. Pharmocologically drugs studied for the prophylaxis as well as treatment of shivering include pethidine, nefopam, tramadol, ketamine, dexmedetomidine, physostigmine, granisetron, magnesium sulphate, clonidine, and dexamethasone [2]. But no single drug proved to be effective, without any unwanted effects. Pethidine was considered as the treatment of choice to treat shivering but many studies have shown that it should be avoided because of its adverse effects [3,4].

Previous studies involving Tramadol and dexmedetomidine have shown varying success rates

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and also few studies have been reported from the Asia and Indian subcontinent. Hence, our aim is to compare the efficacy, hemodynamic variability and complications of tramadol and dexmedetomidine in the treatment of shivering after spinal anesthesia.

Materials and Methods

This is a prospective, randomized study that included 80 patients posted for elective surgeries under spinal anesthesia and developed shivering.

Inclusion Criteria

Patients of both genders between 18–70 yrs age with American Society of Anesthesiologists (ASA) class 1 and 2.

Exclusion Criteria

Patients of ASA 3 and above, those with cardiac, liver and renal diseases, those allergic to any of the study drugs or patient refusal and pregnant patients were excluded.

The patients who developed shivering under spinal anesthesia were chosen for the study and randomly allocated to two groups with 40 patients in each group.

Group T: Subjects received tramadol 1 $mg.kg^{-1}$,

Group D: Subjects received dexmedetomidine 0.5 $mcg.kg^{-1}$.

ECG, blood pressure, O_2 saturation and temperature were noted in all patients. The operating room temperature was maintained at 22^0C for all the surgeries. No external warming devices were used and fluids were administered at room temperature to all patients. The patients received spinal anesthesia with 25 gauge Quincke spinal needle to achieve a block of at least T10 depending on the type of surgery. Patients who developed shivering were included in the study.

For measuring shivering intensity, a scale of 1–4 as per Wrench was used as following [5].

Grade 1: Piloerection, peripheral vasoconstriction, peripheral cyanosis, but without visible muscle activity.

Grade 2: Visible muscle activity confined to one muscle group.

Grade 3: Visible muscle activity in more than one muscle group.

Grade 4: Taken as gross muscle activity involving the whole body.

The hemodynamic monitoring was continued after the administration of study drugs. The time taken to control shivering, and adverse effects like nausea, vomiting, dry mouth and also recurrences of shivering were observed. The monitoring was done for two hours after the administration of spinal anesthesia.

Statistical analysis was done using a standard statistical program, Statistical Package for Social Sciences version 17.0. The time taken to control shivering, heart rate and blood pressure were taken as mean ± standard deviation. The level for all analyses was set at $p = 0.05$ with a p-value less than 0.05 was considered statistically significant and p-value <0.01 was considered extremely significant.

Results

In the present study incidence of shivering was 40%. Written informed consent was taken from 200 patients undergoing various surgeries under Spinal anesthesia, until the time 80 patients who developed shivering were selected in the study.

Age, gender, weight, duration of surgery and duration of spinal anesthesia are expressed in Mean ± SD. p value <0.05 is significant (Table 1).

All the demographic details in the study were insignificant when compared in 2 groups.

Table 1: Demographic data in study

Parameter	Dexmedetomidine N=40	Tramodol N=40	P-value
Age(in years)	39±10.2	40.1±9.7	0.71
Gender(M/F)	14/26	18/22	0.21
Weight in Kgs	61.5±17.3	62.8±18.7	0.92
ASA 1 and 2	40	40	1
Duration of surgery (in mins)	62.3±7.8	65.8±7.5	0.27
Duration of spinal anesthesia(mins)	135.6±17.8	137±18.6	0.29

There was no statistically significant difference in time for the onset of shivering between the two groups. There is difference in the time interval between administration of drug after the onset of shivering and cessation of shivering. It was significantly shorter with dexmedetomidine. Recurrence of shivering was observed in 2 patients with dexmedetomidine and in 4 patients with tramadol (Table 2).

Table 2: Parameters for post-spinal anaesthesia shivering

Parameter	Dexmedetomidine	Tramadol	P-value
Onset of shivering (in mins)	21.4±11.2	20±10.5	0.95
Time of control on shivering (in mins)	2.67±0.56	6.01±0.96	0.0027
Response rate	100 %	100 %	1
Recurrence	2/40(5%)	4/40(10%)	

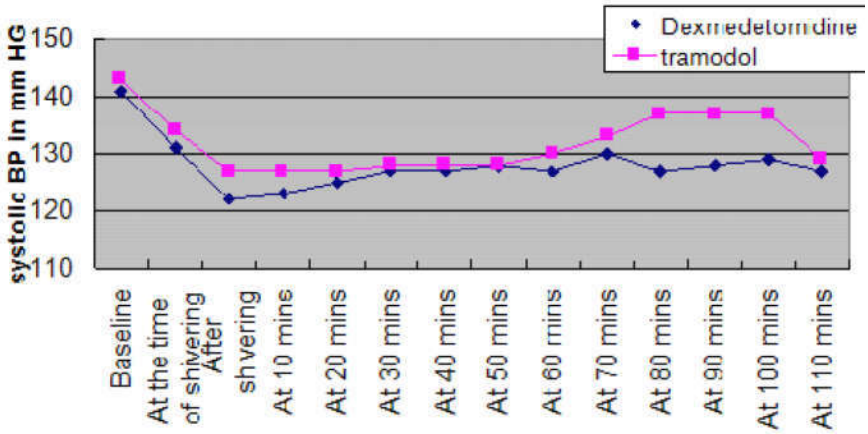

Fig. 1: Comparison of systolic blood pressure at various time intervals in the two groups

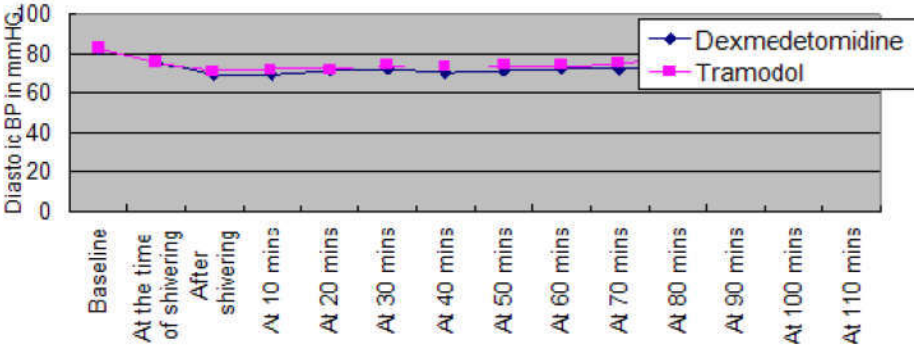

Fig. 2: Comparison of diastolic blood pressure at various time intervals in the two groups

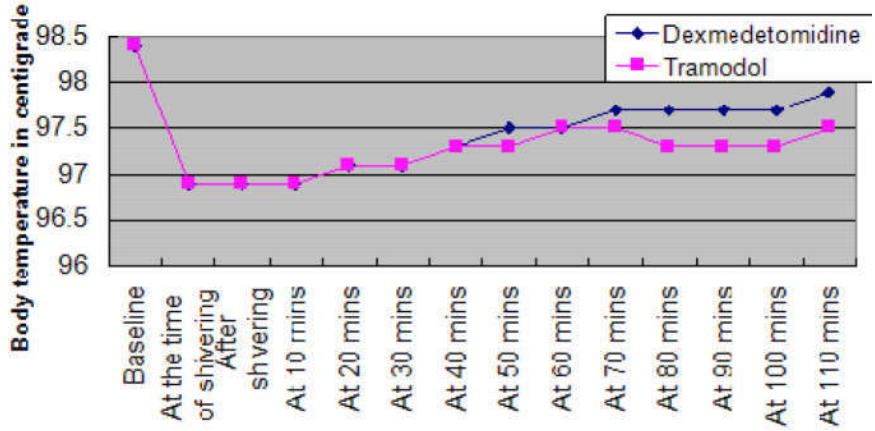

Fig. 3: Comparison of axillary temperature at various time intervals in the two groups

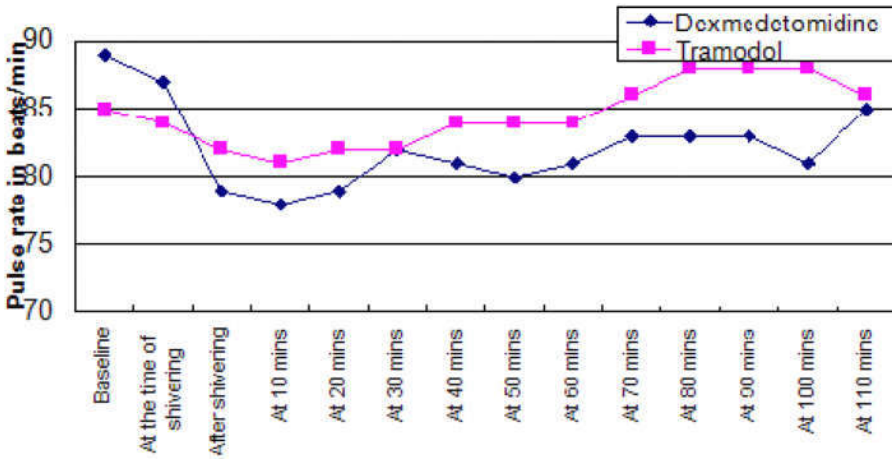

Fig. 4: Comparison of pulse rate at various time intervals in the two groups

Table 3: Adverse reactions in study groups

Parameter	Dexmedetomidine	Tramodol
Nausea	0	9
vomiting	0	6
Sedation	7	8
Hypotension	0	0
Bradycardia	0	0
Respiratory depression	0	0

HR, mean blood pressure, body temperature variations were insignificant in both groups on comparision with each other.

Nausea and vomiting was observed in tramadol group, and absent in the dexmedetomidine group.

Discussion

Tramadol is an opioid analgesic, whose effect is mainly mediated through mu receptors with minute effect on delta and kappa receptors. opioid or serotonergic and noradrenergic activity mediate anti-shivering action of tramadol [6,7,8]. It is a well-known agent and used in the treatment of post-anaesthetic shivering.

Alpha-2 adrenergic agonists are frequently used for anaesthesia and also in intensive care units. Dexmedetomidine is an Alpha-2 adrenoceptor agonist, with analgesic, antihypertensive, sedative and anti-shivering effects or properties [9]. The anti-shivering property of alpha adrenoceptor agonists is mediated by binding to Alpha-2 receptors that results in vasoconstriction and anti-shivering effect. In addition it has hypothalamic thermoregulatory action [10]. Dexmedetomidine decreases vasoconstriction and shivering thresholds and are thought to act on the central thermoregulatory system thus preventing shivering peripherally. It is widely used along with local anaesthetics in spinal anaesthesia and also in peripheral nerve blockade, for sedation in mechanically ventilated patients in the Intensive Care Units, and also as supplementation of post-operative analgesia. Many studies evaluate importance of dexmedetomidine in the treatment of shivering [11]. It can be an alternative and better choice because of its effects in relation to 'anti-shivering' and sedation.

Shivering is common complication in patients who are undergo surgery under neuraxial anesthesia. Shukla et al. [2] reported incidence of shivering in patients undergoing surgery under regional anesthesia at 40–70%. Tanveer Singh Kundra et al. [12] reported an incidence of 41% which is in correlation with our study which is 40%.

Tanveer Singh Kundra et al. [12] study reported the time to cessation of shivering was significantly lesser with dexmedetomidine in comparision with tramadol ($p < 0.001$). The recurrence rate of shivering was less (6%) with dexmedetomidine in comparision to tramadol (16%). Nausea and vomiting was found to be more in the case of tramadol in his study which is in correlation with our study noting that onset of shivering and cessation of shivering was significantly less in use of dexmedetomidine when

compared to tramadol. There was recurrence of shivering in dexmedetomidine group- 2 patients and 4 patients tramadol group in present study. The patients were given rescue doses of dexmedetomidine or tramadol if needed .

The efficacy of dexmedetomidine is similar to that of a previous study by Blaine Easley et al. [13] who studied the role of dexmedetomidine in the treatment of postoperative shivering in children. All children had a cessation of shivering within 3.5±0.9 min, while in our study cessation of shivering is within 2.9±0.23 min (174.12 ± 14.366). While Blaine Easley et al. recorded their results as the number of patients who had stopped shivering after 1 min, after 2 min and so on, and then extrapolated the time taken for cessation of shivering from these data. However, in our study, we directly observed the time taken for shivering to stop.

Our study results indicate that dexmedetomidine takes less time to control shivering. The incidence of adverse effects like nausea and vomiting was found to be more in case of tramadol when compared to dexmedetomidine. In the present study, shivering recurrence was 5% in dexmedetomidine group and 10% in the tramadol group, recurrence rates with dexmedetomidine and tramadol were comparable and there was no significant difference.

Mittal G et al. [14], Abdel Ghaffar HS et al. [15] Bansal P and Jain G, Chan AM et al. [16], found a similar range of tramadol response ranging from around 70-80%. Recurrence rates with dexmedetomidine have been reported in range of 0-10% in studies of Mittal G et al., Abdel Ghaffar HS et al., Blaine Easley R et al. with tramadol in range of 0-9%. Tramadol caused nausea (22%) and vomiting (15%) more in comparison to dexmedetomidine which is similar to study done by Mittal G et al., Shukla U et al. [16,17]. Myles PS et al., have reported a strong positive correlation between postoperative nausea, vomiting and patient dissatisfaction after surgery and anaesthesia [18]. More studies are needed to be undertaken with varying dose ranges to complete the results of this study. Absence of nausea and vomiting during dexmedetomidine usage, is advantageous for the surgeon, anaesthetist as well as the patient. It provided more comfort to the patient, improved surgical conditions, maintain hemodynamic stability and also provided amnesia during surgery.

Conclusion

Dexmedetomidine has better or increased efficiency and faster control than tramadol when used to treat shivering that develops after spinal anaesthesia without any unwanted side effects as well as inducing a comfortable sedation for the patient. Tramadol though effective to treat shivering in post spinal anaesthesia cases has a low efficacy as compared to dexmedetomidine as well as causes an increased incidence of unwanted nausea and vomiting. Dexmedetomidine is a useful substitute to tramadol for cessation of post-spinal anesthesia shivering.

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