

Comparative Evaluation on the Efficacy of Dexmedetomidine and Tramadol in Treatment of Post Spinal Anaesthesia Shivering

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Abstract

Original Research Article

Shivering is very unpleasant and stressful for the patient during perioperative period. Various pharmacological and non-pharmacological methods have been tried for controlling intraoperative shivering with varying success. Here we are comparing the effects of 0.5µg/kg of iv.Dexmedetomidine with 0.5mg/kg of iv.Tramadol for the treatment of shivering developed intraoperatively after spinal anesthesia. This prospective randomized double blind comparative study was conducted in the Department of Anesthesiology of a tertiary care hospital. 100 patients who developed shivering intraoperatively after spinal anesthesia were enrolled in this study and randomized equally into two groups. Group I received 0.5µg/kg of iv.Dexmedetomidine and Group II received 0.5mg/kg of iv.Tramadol after the development of shivering. Response rate, time of cessation of shivering, recurrence, hemodynamics, temperature and side effects were noted. The data obtained was compiled systematically and analyzed statistically using Students T test and chi-square test. Shivering ceased in all patients who received Dexmedetomidine and Tramadol. Time of cessation of shivering was significantly less with Dexmedetomidine than with Tramadol (P<0.001). Recurrence rate of shivering with Dexmedetomidine was less compared to Tramadol. Nausea and vomiting occurred significantly more in Tramadol group. Dexmedetomidine caused moderate sedation. There was no hemodynamic instability in either group. In conclusion, Dexmedetomidine is equally effective as Tramadol and provides faster relief from shivering with comfortable sedation with less side effects.

Keywords: Dexmedetomidine, Hemodynamics, Lower abdominal surgery, Post-operative nausea and vomiting, Shivering, Tramadol.

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INTRODUCTION

Subarachnoid block or spinal anaesthesia is a popular and safe technique for various surgeries. About 40-60% of patients under spinal anaesthesia develop shivering.

Shivering is defined as an involuntary repetitive action of the skeletal muscles. It is a physiological response of the body to raise core temperature by increasing the metabolic heat production. It may be normal thermoregulatory shivering in response to body's hypothermia or maybe as a result of release of cytokines in response to surgical intervention. In a patient with shivering, oxygen consumption may increase by 200-500% along with rise in CO₂ production. In patients with known coronary heart disease or limited myocardial oxygen reserve, shivering may affect the myocardial function. Shivering elevates intraocular pressure and may increase wound pain. Even though shivering is not a life threatening process, it can be a discomfort for the patient and may

interfere with monitoring of pulse, blood pressure, oxygen saturation, and electrocardiogram.

Various pharmacological and non-pharmacological methods have been studied to control intraoperative shivering. Some of the drugs used to treat shivering are Meperidine, Ketamine, Midazolam, Tramadol, Dexmedetomidine and Ondansetron.

Tramadol is a synthetic opioid-receptor agonist. It inhibits the neuronal uptake of norepinephrine and 5-hydroxy tryptamine. It has analgesic action with less chance of depression of ventilation. Presently it is a widely used drug for the treatment of shivering. Tramadol [1] has high safety profile and weak sedative properties, but may cause nausea and vomiting which can be very distressing for the patient.

Dexmedetomidine, a centrally acting alpha-2 adrenergic agonist, has been used as a sedative,

analgesic and is known to reduce the shivering threshold. Various studies [2] have been performed using Dexmedetomidine in the prophylaxis of post-operative shivering.

In our study we are comparing the effects of intravenous Dexmedetomidine (0.5 mcg/kg) and Tramadol (0.5 mg/kg) for post-spinal anaesthesia shivering in patients undergoing lower abdominal and lower limb surgeries.

MATERIALS AND METHODS

Source of data

This prospective randomized double blind comparative study consists of 100 patients scheduled for lower abdominal and lower limb surgeries at Cosmopolitan hospital, Thiruvananthapuram, Kerala, during 2013 June-July 2014.

Inclusion Criteria

After approval of the Institutional Ethics Committee, patients who had given written informed consent, of ASA 1&2 physical status, aged 18-60yrs, weighing 45-65kg and height 145-165cm, of both sexes, underwent lower abdominal and lower limb surgeries under subarachnoid block, and developed shivering during surgery.

Exclusion Criteria

Patients who had not given written consent, ASA physical status 3 or more, allergic to any of the drugs, with thyroid disorders, uncontrolled diabetes mellitus, hypertension, compromised cardiovascular status, obesity, fever, psychiatric disorders and seizure disorders, substance or alcohol abuse, those who are contraindicated to spinal anaesthesia and pregnant women.

For a study power of 80% with 95% confidence and to detect a response rate of 96% and 73% respectively in the two groups as determined in previous studies, the estimated number of participants in each group comes to be 45 using Open Epi version 3.01 open source calculator. To round off, we included additional 5 patients in each group and the sample size as 50 per group.

Patients were randomly allocated to Group I and II on the basis of computer generated random labels. The computer generated group number was put in a closed opaque envelope. An anesthesiologist not related to study was asked to open the closed envelope containing computer generated group number, at start of shivering in a patient. He prepared the drug in a 10ml syringe and sent it for use without labelling, but kept a record of the same. If the second dose was required, it was again sent in an unlabeled syringe. The administering anesthesiologist also was not told which drug was being given. He would fill up the study proforma and this would be collected by the

anesthesiologist who had prepared the drug, and be put back inside the torn envelope. At the end of the study, these envelopes were handed over to the principal investigator.

Pre-anesthetic evaluation was done, all patients were visited on the previous day of surgery, reassured, explained in detail the anesthesia technique, method of assessing sensory and motor blockade, and that if the patient developed intraoperative shivering one of the study drugs will be given as treatment. They were also informed about the possible adverse effects, doubts were cleared and informed consent was taken. Advised fasting regime 6hrs solid foods and 2hrs clear fluids. Tab.Ranitidine 150mg + Tab.Alprazolam 0.5mg was given on previous night of surgery.

In the pre-medication room, a multipara monitor was attached and baseline parameters like heart rate, noninvasive blood pressure, respiratory rate, SPO2 and axillary temperature were recorded and monitored throughout the perioperative period. 18G intravenous cannula was secured and Ringer Lactate solution 10ml/kg/hr (of room temperature) were started. Under aseptic precautions, lumbar subarachnoid block was given with injection 0.5% hyperbaric Bupivacaine 15mg using 26G or 25G Quinke spinal needle at L3-L4 or L4-L5 interspace in lateral decubitus position. Patient kept in supine position, all monitors were continued, and given oxygen at flow rate of 4L/min throughout the procedure.

Sensory blockade was assessed using cold ice-pack in the midaxillary plane, and motor blockade by Modified Bromage scale. Patients were covered with one layer of surgical drape. The temperature in the operation theater, recovery room and PACU were kept between 22-24°C. Patients were closely monitored for occurrence of shivering during surgery. Grading of shivering was done as per Wrench IJ *et al.*

Grade 0- No shivering.

Grade 1- One or more of the following: Piloerection, peripheral vasoconstriction, peripheral cyanosis without any cause 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- Gross muscle activity involving the whole body.

Patients who developed shivering of Grade 3-4 were included in the study and were randomly divided into Group I and II. Group I patients were given 0.5 mcg/kg Dexmedetomidine diluted in 10 ml of normal saline and Group II patients were given 0.5 mg/kg of Tramadol diluted in 10ml of normal saline over 10 minutes and recorded the following.

- Time of onset of shivering (Time at which shivering started after subarachnoid block).
- Severity of shivering.
- Time of disappearance of shivering.
- Time of recurrence, if present. (Defined as the time between cessation of shivering after the first dose of the drug and recurrence of shivering).
- Response rate (number of patients in which shivering ceased after treatment in 15 min).

If the shivering did not subside by 15 min, the treatment was considered to be not effective. Patients who did not respond or in whom recurrence of shivering occurred, were treated with additional dose of Dexmedetomidine 0.25 mcg/kg iv or Tramadol 0.25 mg/kg iv in the respective groups. Those patients who did not respond to additional dose would be regarded as treatment failure.

Baseline systolic and diastolic pressure, heart rate, axillary temperature, side effects like nausea, vomiting, itching, bradycardia (<60/min), hypotension (<20% of basal systolic or diastolic blood pressure), oxygen saturation and sedation score were recorded.

Sedation score was assessed as per modified Ramsay score:

1. Conscious or agitated.
2. Cooperative or tranquilized.
3. Drowsy but respond to command.
4. Asleep but brisk response to light glabellar tap or loud sound
5. Asleep with sluggish response to glabellar tap.

6. Asleep and no response.

Ramsay score of 4 or more was considered excessive.

At the end of surgery, patients were observed in the recovery room for 30 minutes and shifted to the PACU and monitored till the time of complete recovery from subarachnoid block.

Statistical analysis

The statistical analysis was done by using the Students T test and chi-square test. The data was expressed as mean±SD or percentage and the p value <0.05 was taken to be statistically significant and a p value <0.001 as highly significant.

RESULTS

Written informed consent was taken from 236 patients scheduled for various lower abdominal and lower limb surgeries under subarachnoid block until the time 100 patients developed shivering and were enrolled in this study. The incidence of shivering in our study came out to be 42.23%.

The demography of both groups were comparable in terms of age, sex ratio, BMI, mean duration of surgery, type of procedure and duration of subarachnoid block (Table 1). Onset of shivering was comparable in both groups (Table 2).

Mean time of cessation of shivering was lesser in Group I than in Group II (Table 2).

Table-1: Demographic profile (MEAN±SD)

Sl.no.	Parameters	Group I	Group II
1	Age in years	42.6±13.3	43.8±14.2
2	Sex (M:F)	23:27	24:26
3	Weight (kg)	61.47±10.66	62.71±11.8
4	Height (cm)	166.75±7.68	167.27±4.87
5	ASA (I/II)	29/21	30/20
6	Duration of procedure (min)	108.22±15.76	107.54±20.45

*SD-standard deviation; *ASA-American Society of Anesthesiologist.

Table-2

Sl.no.	Parameters	Group I	Group II	P value
1	Time of onset of shivering (min)	36.28±4.32	37±3.46	.962
2	Time of cessation of shivering (min)	2.94±1.19	7.15±1.75	<.001**
3	Time of recurrence (min)	69±15.32	71.75±19.17	0.791

Data expressed as mean±SD. **P <0.001 statistically highly significant.

Shivering disappeared in all patients of both groups. 3 patients in group I and 7 patients in group II developed recurrence of shivering and were given second dose of Dexmedetomidine or Tramadol. Shivering stopped in all the patients. The response rate was 100% in both the groups.

There was no statistically significant difference with respect to systolic/diastolic blood pressure, axillary temperature, heart rate and oxygen saturation between the two groups (fig. 1-fig.4). There was no statistically significant difference with respect to baseline heart rate and heart rate at onset of shivering. However the heart rate decreased significantly in Group I as compared to Group II immediately after cessation of shivering.

There was no statistically significant difference with respect to heart rate at all other time intervals (fig.4).

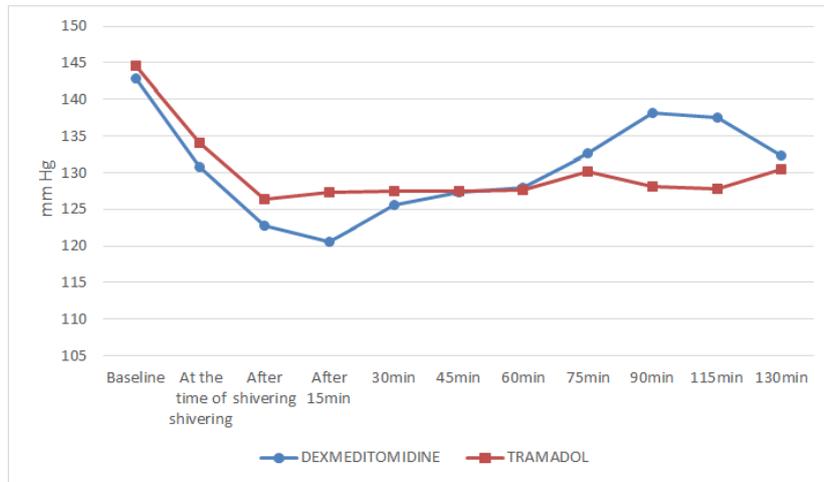


Fig-1: Systolic BP

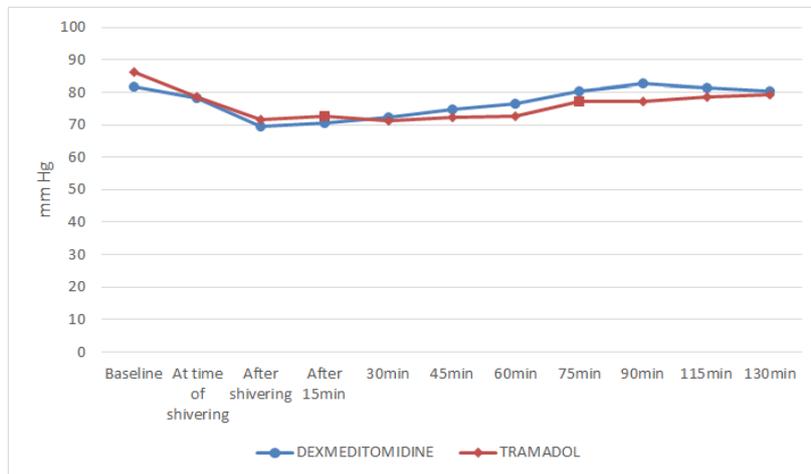


Fig-2: Diastolic BP

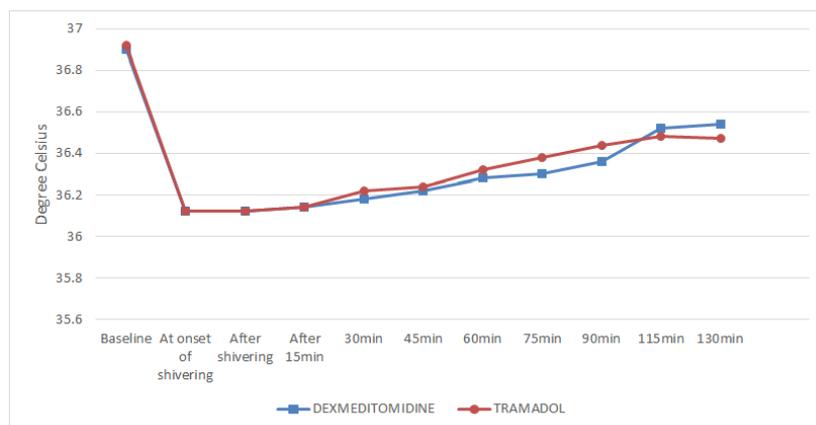


Fig-3: Axillary Temperature

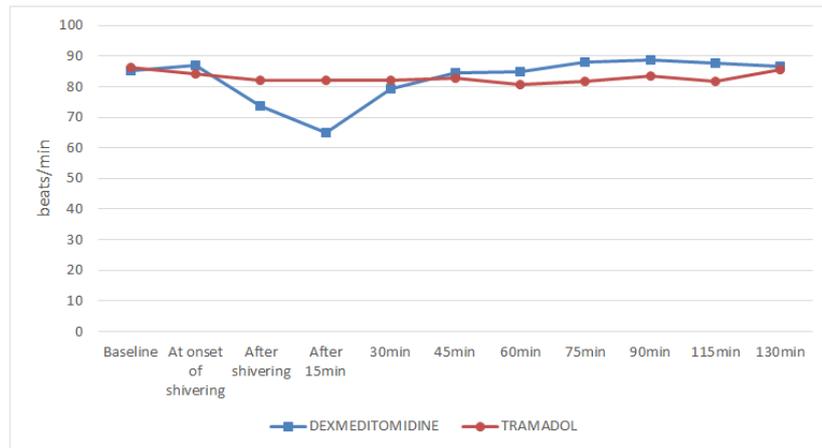


Fig-4: Heart Rate

Side effects

Side effects noted were nausea, vomiting, hypotension, bradycardia, pruritus, oxygen desaturation.

Nausea and vomiting were more in Group II than Group I and were statistically highly significant (Table 3).

Table-3

Sl.no	Symptoms	Group I	Group II	P value
1	Nausea	0	13	<.001**
2	Vomiting	0	4	<.006**
3	O2 desaturation	0	0	-
4	Hypotension	3	0	.24
5	Bradycardia	1	0	1.00
6	Pruritus	0	0	-

**P<0.001 highly significant

No patients in either group had hypotension, itching or oxygen desaturation. One patient in Group I had bradycardia, whereas no patient in Group II had bradycardia.

Sedation: Patients of Group I were more sedated than patients of Group II P<0.001 (Table 4).

Table-4

Sedation Score	Group I		Group II		P value
1	0	0%	0	0%	
2	0	0%	38	76%	
3	15	30%	12	24%	
4	35	70%	0	0%	<.001**
5	0	0%	0	0%	
6	0	0%	0	0%	

DISCUSSION

Shivering is an unpleasant sensation especially after surgery. The cause of shivering after regional anesthesia is not well understood, but the probable cause could be decrease in core body temperature after sympathetic block, enhanced cutaneous blood flow, peripheral vasodilation which leads to increased heat loss, rapid infusion of cold intravenous fluids, cold temperature of the operation theatre and cold anaesthetic drug stimulating thermosensor receptors in the spinal cord. The adverse effects of shivering are well known and methods are being continuously evaluated to decrease these adverse effects.

Based on previous studies, Shukla *et al.* [3] have reported the incidence of shivering in patients undergoing surgery under regional to be 40-70%. In this study the incidence of shivering came out as 42%. In our study we could not find any relationship of shivering to age, gender, type of surgery, duration of surgery. Most of the patients were normothermic. So shivering related to hypothermia was ruled out.

John M *et al.* reported that a plan to prevent hypothermia and shivering in the intraoperative period should involve many methods [4]. They also highlighted the importance of covering drape, clothes, fluid warming and keeping the ambient room temperature to

21°C. Many drugs have been evaluated for their effectiveness for control of shivering like Pethidine, Tramadol, Buprenorphine, Clonidine, Propofol, Ketamine, Dexmedetomidine etc. But still an effective drug for control of shivering has not yet been found.

In this study we compared the effectiveness of two drugs, Tramadol, a synthetic opioid, and Dexmedetomidine, a selective alpha-2 adrenoceptor agonist. Tramadol hydrochloride, an μ opioid receptor agonist acts on central monoaminergic pathways and cause inhibition of the neuronal uptake of serotonin secretions which has a major role in regulating the body temperature regulation center. Tramadol is an established drug in the treatment of shivering.

In this study we found that Dexmedetomidine is equally effective as Tramadol in treating post spinal anesthesia shivering. This is similar to that of the study conducted by Blaine Easley *et al.* [5] who studied the role of Dexmedetomidine in treatment of post-operative shivering in children. All children have cessation of shivering within 3.5 ± 0.9 minutes while in our study cessation of shivering occurred in 2.9 ± 0.2 minutes. This difference could be due to (1) Blain Easley *et al.* studied a small sample size of 24 patients whereas our sample size was 50. (2) Different methodology used for seeing the time for cessation of shivering.

In this study cessation of shivering with Tramadol is 4.69 ± 0.38 min. This is in accordance with the study conducted by Shukla *et al.* [3]. From our study we found that the time interval from the administration of the treatment drug to cessation of shivering was significantly less with Dexmedetomidine than Tramadol.

Recurrence rate with Dexmedetomidine have been reported in range of 0-10% (Blain Easley R *et al.*, Mittal G *et al.*) [5, 6], while with Tramadol 0-9% (Benzal P and Jain G Suldo) [7, 3]. In our study we found recurrence rate of 6% with Dexmedetomidine. Recurrence rate of 16% with Tramadol which was similar to the study conducted by Joshi S.S. [8].

In this study the incidence of recurrence of shivering with Dexmedetomidine was as low as 6% compared to Tramadol 16%, but the difference was not statistically significant ($P < 0.110$).

In our study 30% patients in Dexmedetomidine group showed Ramsay sedation score of 3, and 70% had a Ramsay Sedation score of 4 without any respiratory depression or oxygen desaturation. It was observed that these patients benefitted from this sedation, and were more comfortable in the recovery room as compared to Tramadol group, similar to the study by Mittal G and Bozjeyk *et al.* [6, 9]

Incidence of nausea and vomiting were higher in Tramadol group and was statistically significant similar to other studies (Mittal G *et al.* and Shukla *et al.*). Myles PS *et al.* [10] have reported a strong correlation between nausea, vomiting, and patient dissatisfaction after surgery and anesthesia.

Dexmedetomidine decreases the heart rate significantly immediately after cessation of shivering, but the incidence of bradycardia was not statistically significant. No patients in the Tramadol group had bradycardia. No patients in either group developed hypotension, similar to other studies. None of the patients in either group had pruritus.

Limitations

We studied only patients undergoing surgical procedures of short duration under subarachnoid block. We could not measure the core body temperature due to the difficulty in placing the probe under subarachnoid block. Instead, we recorded the axillary temperature at regular intervals perioperatively until the end of study.

CONCLUSION

Dexmedetomidine is equally effective as Tramadol in attenuating the post spinal shivering. It provides faster relief from shivering, comfortable sedation and less nausea and vomiting compared to Tramadol.

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