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Original Article

Comparative Study of Dexmedetomidine, Clonidine, and Tramadol for Control of Post-operative Shivering after Surgery under Spinal Anesthesia

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Abstract

Background and Aims: Shivering is a common post-anesthetic occurrence defined as the involuntary repetitive activity of skeletal muscle. It is a common and distressing experience for many patients and occurs either during or immediately after the surgery. The incidence of shivering following spinal anesthesia is 30–60%. It is widely used as a safe anesthetic technique for both elective and emergency operations, including all open gynecology and obstetrics surgery and orthopedic surgery. The present study was carried out to compare the effects of tramadol, clonidine, and dexmedetomidine on post-operative shivering after spinal anesthesia.

Materials and Methods: This prospective randomized double-blind study was conducted in Guru Nanak Dev Hospital attached to Government Medical College, Amritsar, after taking written informed consent from patients in their vernacular language and approval from the Institutional Ethics Committee. This study was conducted on 90 patients, aged 18–60 years, American Society of Anesthesiologists Grade I and II, who were scheduled to undergo elective surgeries under spinal anesthesia and those who developed shivering were also included in the study. The patients were randomly divided into three groups, i.e., Group A, Group B, and Group C, receiving tramadaol, clonidine, and dexmedetomidine, respectively, for control of shivering. The incidence of control of shivering, along with the mean time taken to control shivering, was noted.

Results: The mean time taken to control shivering in Group C was 2.8 ± 0.12 min, Group A was 5.2 ± 0.41 min, and Group B was 6.14 ± 0.41 min. Group C takes the least time, whereas Group B takes more time to control shivering. The sedation achieved with dexmedetomidine was better than that achieved with clonidine and tramadol.

Conclusion: In conclusion, all drugs in this study effectively treated post-spinal shivering. However, the mean time taken by dexmedetomidine to control shivering was the least as compared to tramadol and clonidine.

Key words: Clonidine, Dexmedetomidine, Shivering, Tramadol

INTRODUCTION

Shivering is a common and distressing experience for many patients and occurs either during or immediately after the surgery. It is defined as an involuntary, repetitive activity of skeletal muscles. The incidence of shivering varies but is very high and it is approximately 40–50%.[1]

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Spinal anesthesia is widely used as a safe anesthesia technique for both elective and emergency operations, including all open gynecology and obstetric surgery, orthopedic and plastic surgery of the lower limb and pelvis, and the majority of urological procedures.[2]

The main causes of shivering are heat loss, increased sympathetic tone, pain, and the systemic release of pyrogens. Shivering during surgery leads to an uncomfortable experience for the patient, which leads to an increase in oxygen consumption and carbon dioxide production by two- to three-fold. Shivering can also increase catecholamine production, lactic acidosis, intraocular pressure, and intracranial pressure.[3]

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Mild shivering increases oxygen consumption like that produced by light exercise, but severe shivering can increase oxygen consumption and metabolic rate by 100–600%. This can prove detrimental to patients with limited cardiac reserve. Shivering also creates difficulty in monitoring the patients, as most of the multiparameter monitors used for anesthesia show erroneous values.

Shivering is a physiological response to core heat production. The core body temperature is maintained within the range of 36.5°C–37.5°C, which is known as the thermo-neutral zone. Thermo-regulatory responses like vasoconstriction and shivering are activated when core body temperature falls below the normal range.[4] The spinal α motor neurons and their axons mediate the neurological mechanism of shivering, with their center at the preoptic nucleus of the anterior hypothalamus.[5]

After spinal anesthesia, shivering is more common than after general anesthesia, as the vasoconstriction effect after heat loss during surgery is lost when the patient is under spinal anesthesia due to sympathetic blockade.

MATERIALS AND METHODS

It was a prospective, randomized, double-blind study conducted in Guru Nanak Dev Hospital attached to Government Medical College, Amritsar, after taking written informed consent from patients in their vernacular language and approval from the Institutional Ethics Committee. This study was conducted on 90 patients, aged 18–60 years, American Society of Anesthesiologists (ASA) Grade I and II, who were scheduled to undergo elective surgeries under spinal anesthesia. Those who developed shivering were included in the study.

The patients who developed shivering under spinal anesthesia were randomly divided into three groups, with 30 patients in each group. Group A patients received tramadol 1 mg/kg intravenously, Group B received clonidine 1 μg/kg intravenously, and Group C received dexmedetomidine 0.5 μg/kg intravenously. The group allotment was decided by the computer-generated random envelope method. The first anesthesiologist opens the envelope, adds the study drug to 100 mL of normal saline, and hands it to the second anesthesiologist, who was blinded to the study drug. He administers the drug for over 10 min and monitors the patient.

A detailed preanesthesia checkup was done a day before the surgery. Details pertaining to the patient's clinical history, general physical examinations, and systemic examinations were taken. An assessment of the patient's airway was done. Patients were instructed to fast for 6–8 h for solids and 2 h for clear fluids before surgery.

On the day of surgery, all the vitals were recorded preoperatively. After shifting the patient, a multiparameter was attached to the patient, and continuous monitoring of pulse rate, blood pressure, respiratory rate, SpO_2, and axillary temperature was done. After venous cannulation, patients were preloaded with Ringer lactate solution. Under all aseptic conditions, the patient was asked to lie in the left lateral position. The back of the patient was painted with betadine and draped. Intervertebral space palpated. A 23G spinal needle was inserted into the L3–L4 space. 0.5% of 3.2 mL of heavy bupivacaine was injected into the subarachnoid space. The patient was immediately turned to a supine position. Oxygenation was started through a simple oxygen mask (5 l/min). Surgery was allowed to proceed under obtaining an adequate level of anesthesia.

The operating room temperature was maintained at 22°C for all the surgeries. No external warming devices were used, and fluids were administered at room temperature to all patients. The patients who developed shivering under spinal anesthesia were randomly divided into three groups, with 30 patients in each group. Group A patients received tramadol 1 mg/kg intravenously, Group B received clonidine 1 μg/kg intravenously, and Group C received dexmedetomidine 0.5 μg/kg intravenously.

The shivering intensity was graded on a scale of 1–4 as per Wrench.

- Grade 1: Patients having one or more of the following: piloerection, peripheral vasoconstriction, or 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: Gross muscle activity involving the whole body. The patients were included in the study when they developed shivering with at least a grade of 2.

The hemodynamic monitoring was continued after the administration of the study drugs. The time taken to control shivering, recurrence, and adverse effects such as nausea, vomiting, dry mouth, and sedation score were observed. The sedation score proposed by Filos *et al*. was followed.

- Grade 1: Awake and alert patient
- Grade 2: Drowsy patient responding to verbal stimuli
- Grade 3: Drowsy but arousable to physical stimuli and
- Grade 4: Unarousable patient.

The monitoring was continued for 2 h after the administration of spinal anesthesia.

Statistical Analysis

After consulting with statisticians and monitoring the parameters of the study, i.e., blood pressure, oxygen saturation, respiratory rate, pulse rate, adverse effects of the study drugs, etc., the power of the study was increased to more than 85%. This study was conducted on 90 patients who were randomly divided into three groups, with 30 patients in each group. The data from the present study were systematically collected, compiled, and statistically analyzed to draw relevant conclusions.

Continuous data were presented as the mean with a standard deviation. Categorical data were expressed as percentages. Numerical variables were normally distributed and compared using the Chi-square test for non-parametric data and the *post-hoc* analysis of variance test for parametric data. The *P*-value was then determined to evaluate the level of significance.

The sample size was calculated keeping in mind at most 5% risk, a minimum of 85% power, and a 5% significance level (significant at the 95% confidence interval). Data were recorded in a Microsoft Excel spreadsheet and analyzed using the statistical Package for IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY, USA: IBM Corp., Chicago, Illinois, USA.

RESULTS

A total of 90 patients were studied and analyzed. The demographic parameters such as age, sex, BMI, ASA grade, and mean duration of surgery were comparable in both groups [Table 1].

The mean time for the onset of shivering in Group A was 23.2 ± 6.38 min, Group B was 24.66 ± 7.12 min, and Group C was 25.2 ± 6.96 min. The difference between the groups was statistically non-significant ($P > 0.05$) [Table 2].

The least time taken to control shivering by the drug was in Group C (2.8 ± 0.12 min), whereas Group A (5.2 ± 0.34 min) and Group B took more time (6.14 ± 0.41). The difference between groups A and B, B and C, A and C is statistically highly significant ($P < 0.001$) [Figure 1].

The sedation score was compared between Group A, Group B, and Group C. The difference between Group A and Group C was statistically significant, but the difference between Group A and Group B, Group B and Group C was found to be statistically nonsignificant [Figure 2].

The incidence of nausea and vomiting was observed in all three groups: Group A had 10 (33.33%) patients, Group B had 1 (3.33%) patient, and Group C had 1 (3.33%) patient.

Table 1: Demographic parameters

Parameter	Group A (*n*=30)	Group B (*n*=30)	Group C (*n*=30)	*P* (NS)
Mean age (years)	40.03±10.29	38.86±12.22	39.46±9.12	>0.05
Sex				
Male	16	14	19	0.426
Female	14	16	11	
ASA grade				
I	21	21	24	>0.05
II	9	9	6	

P>0.05=NS. NS: Non-significant, ASA: American Society of Anesthesiologists, *n*: Number of patients

Table 2: Time of onset of shivering (min)

Time of onset of shivering (min)	Mean±SD		
	Group A	Group B	Group C
Mean time of onset of shivering	23.2±6.38	24.66±7.12	25.2±6.96
P			
Group A versus B		0.425	
Group B versus C		0.742	
Group A versus C		0.250	

SD: Standard deviation

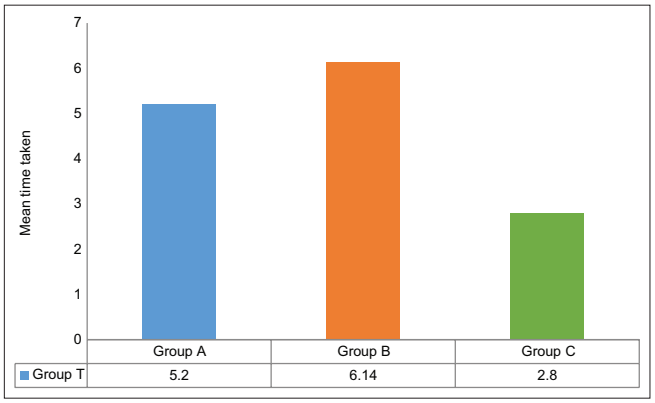

Figure 1: Mean time taken to control shivering

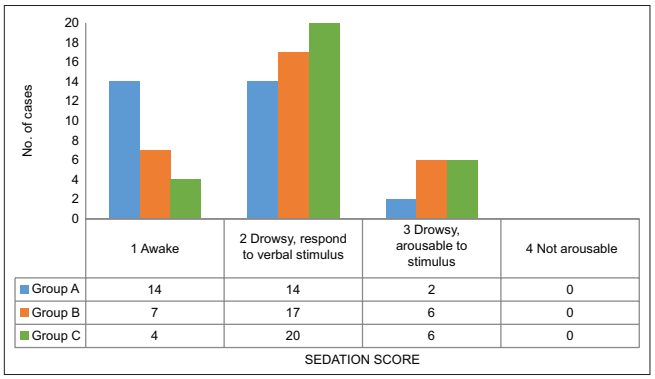

Figure 2: Sedation score

The difference between groups A and B and groups A and C is statistically highly significant, but the difference between groups B and C is statistically non-significant [Figure 3].

Complications such as bradycardia and hypotension were noted in each group. In our study, hypotension was observed in 11 patients (36.67%) in Group C, 8 patients (26.67%) in Group B, and 5 (16.67%) patients in Group A. Hence, the difference between these groups was statistically non-significant ($P > 0.05$). In our study, bradycardia was observed in all three groups. Group C has 6 (20%) patients, Group B has 3 patients (10 patients), and Group A has 2 (6.67%) patients. Hence, the difference between these groups was statistically non-significant [Table 3].

DISCUSSION

The study was carried out to compare the efficacy of tramadol, clonidine, and dexmedetomidine to control shivering in patients undergoing surgery under spinal anesthesia.

In the present study, the mean time taken by the drug to control of shivering. Group C was 2.8 ± 0.12 min, Group A was 5.20 ± 0.34 min, whereas Group B was, i.e., 6.14 ± 0.41 min. Group C takes the least time, whereas Group B takes more time to control shivering. The difference between Group A and B, Group B and C, and Group A and C is statistically highly significant ($P < 0.001$).

A similar study was conducted by Kundra *et al.* in 2017 to compare the efficacy of dexmedetomidine and tramadol on post-spinal anesthesia shivering. They concluded that the time to the cessation of shivering was significantly less with dexmedetomidine (2.9 ± 0.23 min) than with tramadol (4.6 ± 0.40 min) ($P < 0.001$). The difference between the groups was statistically highly significant.[6]

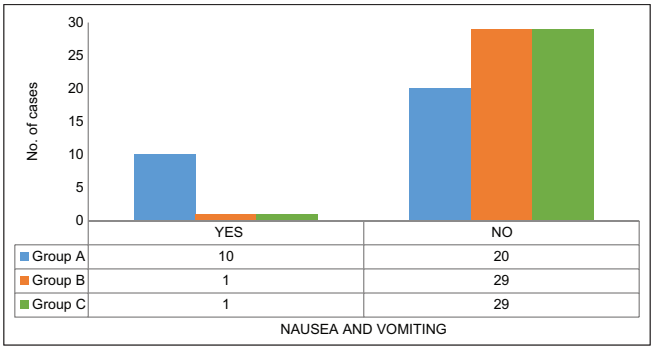

Figure 3: Incidence of nausea and vomiting

Table 3: Complications

Parameter	Group A (*n*=30)	Group B (*n*=30)	Group C (*n*=30)	*P* (NS)
Bradycardia	2	3	6	>0.05
Hypotension	5	8	11	0.426

NS: Non-significant

A similar comparative study was done by Verma *et al.* in 2018 to evaluate dexmedetomidine and tramadol for attenuation of post-spinal anesthesia shivering. They concluded that the time taken for cessation of shivering of significantly less with dexmedetomidine 2.95 ± 1.18 min than in tramadol 7.15 ± 1.77 min ($P < 0.05$). The difference between these groups was statistically significant.[7]

In our study, sedation scores were compared between Group A, Group B, and Group C. The difference between Group A and Group C was statistically significant, but the difference between Group A and Group B, Group B and Group C was statistically non-significant.

A similar study was done by Ramesh *et al.* in 2019 on a clinical comparative study between intravenous dexmedetomidine and tramadol for the control of post-spinal anesthesia shivering. They concluded that patients on dexmedetomidine were more sedated than those on tramadol ($P < 0.001$). The difference between these groups was statistically highly significant.[8]

A similar study was done by Wang *et al.* in 2020 on intravenous dexmedetomidine versus tramadol for the treatment of shivering after spinal anesthesia (randomized controlled trial). They concluded that patients on dexmedetomidine had a higher incidence of sedation than tramadol ($P = 0.005$). The difference between groups was statistically significant.[9]

In our study, bradycardia and hypotension were compared between Group A, Group B, and Group C. The difference between Group A and Group C, Group A and Group B, and Group B and Group C were statistically non-significant. However, the incidence of bradycardia and hypotension was more with dexmedetomidine as compared to tramadol and clonidine.

A similar study was done by Verma *et al.* in 2018 to compare dexmedetomidine and tramadol for attenuation of post-spinal anesthesia shivering. They concluded that hypotension was observed in three cases of tramadol compared to dexmedetomidine. Hence, the difference between these groups was statistically non-significant ($P = 0.24$).[7]

CONCLUSION

In conclusion, all drugs in this study, namely tramadol (1 mg/kg IV), clonidine (1 μg/kg IV), and dexmedetomidine (0.5 μg/kg IV) effectively treated post-spinal shivering. However, the mean time taken by dexmedetomidine to control of shivering was the least, i.e., 2.8 min, as compared to other drugs, and the recurrence rate is also less with dexmedetomidine.

There was no statistically significant difference in hemodynamic changes in all three groups.

REFERENCES

1. De Witte J, Sessler DI. Perioperative shivering: Physiology and pharmacology. Anesthesiology 2002;96:467-84.
2. Ozaki M, Kurz A, Sessler DI, Lenhardt R, Schroeder M, Moayeri A, *et al*. Thermoregulatory thresholds during epidural and spinal anesthesia. Anesthesiology 1994;81:282-8.
3. Katyal S, Tewari A. Shivering: Anaesthetic considerations. J Anaesth Clin Pharmacol 2002;18:363-76.
4. Henneman E. Organization of the motoneuron pool: The size principle. In: Mountcastle VB, editor. Medical Physiology. 14th ed. St Louis: CV Mosby; 1980. p. 718-41.
5. Alfonsi P. Postanaesthetic shivering: Epidemiology, pathophysiology, and approaches to prevention and management. Drugs 2001;61:2193-205.
6. Kundra TS, Kuthiala G, Shrivastava A, Kaur P. A comparative study on the efficacy of dexmedetomidine and tramadol on post-spinal anesthesia shivering. Saudi J Anaesth 2017;11:2-8.
7. Verma A, Bhandari D, Dhande P, Jain S, Tidke S. Comparative evaluation of dexmedetomidine and tramadol for attenuation of post-spinal anaesthesia shivering. J Clin Diagn Res 2018;12:78-80.
8. Ramesh K, Bhushanam KN, Sharma BA, Kumar SS. A clinical comparative study between intra venous dexmedetomidine and tramadol for control of post spinal anesthesia shivering. J Dent Med Sci 2019;18:26-31.
9. Wang J, Wang Z, Liu J, Wang N. Intravenous dexmedetomidine versus tramadol for treatment of shivering after spinal anesthesia: A meta-analysis of randomized controlled trials. BMC Anesthesiol 2020;20:104.

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