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Comparative Study of Tramadol Versus Dexmedetomidine in the Prevention of Intraoperative Shivering in Patients Undergoing Surgery Under Subarachnoid Blockade

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ABSTRACT

Regional anaesthesia (spinal anaesthesia) is widely used as a safe anaesthetic technique for both elective and emergency operations. Shivering causes several undesirable physiologic consequences including increase in oxygen consumption, hypercarbia and increase in minute ventilation. Present study was aimed to compare intravenous tramadol versus intravenous dexmedetomidine in the prevention of intraoperative shivering in patients undergoing surgery under subarachnoid blockade. Present study was prospective, randomised, comparative study, conducted in patients of age 20-65 years, either gender, corresponding to ASA status I/II undergoing elective surgery under spinal anaesthesia <150 min duration with surgeries involving lower abdomen, urological, gynaecological, orthopaedic and lower limb extremity. In present study 60 patients were randomly allocated into group T (n = 30, received tramadol) and group D (n = 30, received dexmedetomidine). Patients having severity score of shivering of 3 and 4 were treated with Pethidine. In group T, incidence of shivering was 23.33% as compared to group D with incidence of 13.33%, difference between two groups was statistically significant (p = 0.045). Onset of shivering after spinal anaesthesia was at 21.4±8.5 min in group T as compared to 26.3±10.3 min in group D, difference statistically significant (p = 0.049). We noted delayed cessation of shivering after medication in group T (4.91±0.93 min) than in group D (3.12±0.71 min), difference was statistically significant (p = 0.01). In group D sedation (23.33%) and hypotension (3.33%) was noted as adverse effects while in group T sedation (10%), hypotension (10%), nausea (6.67%) and vomiting (6.67%) were noted. Intravenous dexmedetomidine had less incidence of intra-operative shivering, late onset of intra-operative shivering and lesser side effects when compared to tramadol for intra-operative shivering in patients undergoing surgery under subarachnoid blockade.

INTRODUCTION

Regional anaesthesia (spinal anaesthesia) is widely used as a safe anaesthetic technique for both elective and emergency operations. Though hypothalamic thermoregulation remains intact during regional anaesthesia, it is associated with greater heat loss than general anaesthesia which is attributed to various reasons like abnormal heat loss due to vasodilatation, impairment of shivering in the area of block and rapid intravenous (IV) infusion of cold fluids^[1].

Shivering causes several undesirable physiologic consequences including increase in oxygen consumption, hypercarbia and increase in minute ventilation. It induces arterial hypoxemia, lactic acidosis, increased intra-ocular pressure, intracranial pressure and interfere with patient monitoring^[2]. Perioperative hypothermia is the primary cause, which occurs due to neuraxial anaesthesia induced inhibition of thermoregulatory mechanism. Shivering occurs as a thermoregulatory response to hypothermia or muscle activity with tonic or clonic patterns and various frequencies have been noticed^[3].

Several pharmacologic and nonpharmacologic strategies are available for the treatment of shivering with no consensus on the gold standard therapy^[4]. The nonpharmacologic strategies include blankets, warming intravenous fluids and use of external warmer. Several drugs have been studied for the prophylaxis as well as treatment of shivering. This includes pethidine, tramadol, nefopam, ketamine, dexmedetomidine, granisetron, physostigmine, clonidine, magnesium sulphate, dexamethasone and urapidil^[5]. Present study was aimed to compare intravenous tramadol versus intravenous dexmedetomidine in the prevention of intraoperative shivering in patients undergoing surgery under subarachnoid blockade.

MATERIALS AND METHODS

Present study was prospective, randomised, comparative study, conducted in department of Anaesthesia at Gmers medical college and hospital, Gotri, Vadodara, Gujarat, India. Study duration was of 1 years (January 2022 to December 2022). Study approval was obtained from Institutional Ethical Committee.

Inclusion criteria:

- Patients of age 20-65 years, either gender, corresponding to ASA status I/II posted for elective surgery under spinal anaesthesia <150 min duration with surgeries involving lower abdomen, urological, gynaecological, orthopaedic and lower limb extremity, willing to participate in present study

Exclusion criteria:

- Patient denial
- Absolute contraindications for subarachnoid blockade
- Inability to communicate with the patient
- Combined spinal and general anaesthesia
- Known drug intolerance or proven allergic reactions to study drugs
- Baseline core temperature >37.5°C or <35.5°C
- Blood transfusion during surgery
- Pregnancy and lactating mothers

Study was explained to patients in local language and written consent was taken for participation and study. Routine pre-operative assessment was done and the patients were kept nil per oral from 10 pm the day prior to surgery. All the patients were pre-medicated with tablet Pantoprazole 40 mg and Alprazolam 0.25 mg orally the day prior to surgery at night and Pantoprazole 40 mg at 6 am on the morning of day of surgery.

Patients were randomly allocated by computer generated random table number (numbered from 1-60). Patients were assigned alternatively by number. with 30 participants in each group:

- **Group T:** Tramadol (n = 30) 0.5 mg kg⁻¹ in 100 mL NS over 10-15 min
- **Group D:** Dexmedetomidine (n = 30) 0.5 µg kg⁻¹ in 100 mL NS over 10-15 min

Present study was a double blinded study and the performer is also unaware of the group of the drug till the end of the trial.

In the operation theatre, pre induction monitors like ECG, NIBP and SpO₂ were connected and baseline values noted. The operating room temperature was maintained at 25°C. Spinal anaesthesia was given in right lateral posture and under standard universal precautions, at L3-L4 or L4-L5 interspace with 26G Quincke spinal needle, intrathecal administration of 15 mg 0.5% bupivacaine heavy was given over a period of 15 sec and patient was turned supine post spinal injection. The study drug was infused by the blind observer.

The haemodynamic parameters were monitored. Attending Anaesthesiologist recorded the time in minutes at which shivering started after spinal anaesthesia (onset of shivering), severity of the shivering, time to the disappearance of shivering and response rate (shivering ceasing within 15 min after treatment). Shivering was graded with a score validated by Crossley and Mahajan^[6] (Table 1).

The patients who developed shivering intra operatively were supplemented with injection Pethidine 0.25 mg kg⁻¹ as rescue drug. Data was

collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. $p < 0.05$ was considered as statistically significant.

RESULTS

In present study 60 patients were randomly allocated into group T (n = 30, received tramadol) and group D (n = 30, received dexmedetomidine). Age (years), weight (kg), BMI (kg m^{-2}), Gender (Male/Female), ASA grade, Duration of surgery (min) and Baseline axillary temperature ($^{\circ}\text{C}$) between both groups were comparable and no statistically significant difference was noted among them (Table 2).

In present study, score 3 and 4 patients were treated. In group T, incidence of shivering was 23.33% as compared to group D with incidence of 13.33%, difference between two groups was statistically significant ($p = 0.045$). Onset of shivering after spinal anaesthesia was at 21.4 ± 8.5 min in group T as compared to 26.3 ± 10.3 min in group D, difference statistically significant. We noted delayed cessation of shivering after medication in group T (4.91 ± 0.93 min) than in group D (3.12 ± 0.71 min), difference was statistically significant ($p = 0.01$). We noted 100% response in both groups. No recurrence or side effects were noted (Table 3).

In group D sedation (23.33%) and hypotension (3.33%) was noted as adverse effects while in group T sedation (10%), hypotension (10%), nausea (6.67%) and vomiting (6.67%) were noted. In present study bradycardia and respiratory depression was not seen in patients (Table 4).

Table 1: Grading of shivering

Shivering grades	Characteristic
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 but not generalised
4	Shivering involving the whole body

Table 2: General characteristics

General characteristics	Group T ------(n=30)-----	Group D ------(n=30)-----	p-value
Age (years)	40.9±9.3	42.1±9.6	0.84
Weight (kg)	64.1±11.5	65.9±10.7	0.64
BMI (kg m^{-2})	23.1±2.1	22.6±2.3	0.41
Gender (M/F)	14/16	15/15	0.67
ASA I/II	21/9	22/8	0.64
Duration of surgery (min)	122.1±23.2	120.5±24.5	0.41
Baseline axillary temperature ($^{\circ}\text{C}$)	36.64±0.35	36.58±0.41	0.67

DISCUSSIONS

Shivering, a common intraoperative problem under spinal anesthesia increases the oxygen consumption considerably and is uncomfortable and distressing to the patient, anesthesiologist as well as surgeon. Also, prevention of postanesthesia shivering, improves the outcome in terms of reduced morbidity and blood loss, improved wound healing and shorter hospital stay^[7].

Tramadol hydrochloride, a μ opioid receptor agonistic drug has a modulatory impact on central monoaminergic pathways and in this way represses the neuronal uptake of noradrenaline/serotonin and energizes 5HT3 discharge, which resets the body temperature regulating center^[8]. Tramadol is a well-established agent in treatment of shivering. The mechanism of anti-shivering action of tramadol may be its opioid or serotonergic and noradrenergic activity or both^[9].

Dexmedetomidine, a potent alpha 2-adrenergic receptor agonist has been used as a sedative agent and is known to reduce the shivering threshold. It acts by decreasing the vasoconstriction and shivering thresholds^[10]. Dexmedetomidine has hypothalamic thermoregulatory effects, acts on the central thermoregulatory system rather than preventing shivering peripherally^[11]. Dexmedetomidine and tramadol are not only effective for shivering treatment but also effective for shivering prevention^[12,13].

Venkatraman *et al.*^[4] studied patients who developed shivering under spinal anaesthesia and compared drugs were tramadol (1 mg kg^{-1}) vs. clonidine (1 mcg kg^{-1}) vs dexmedetomidine (0.5 mcg kg^{-1}). They concluded that dexmedetomidine is better than tramadol and clonidine in the control of shivering because of its faster onset and less recurrence rate. Patil and Sonawane^[14] noted that dexmedetomidine is faster, more effective with lesser side effects when compared to tramadol in control of intraoperative shivering after giving of spinal anaesthesia.

Kundra *et al.*^[15] noted that time to cessation of shivering was significantly less with dexmedetomidine ($174.12 \pm 14.366\text{s}$) than with tramadol ($277.06 \pm 23.374\text{s}$) ($p < 0.001$). The recurrence rate of shivering with dexmedetomidine was less (6%)

Table 3: Parameters for post spinal anaesthesia shivering

Parameters	Group T ------(n=30)-----	Group D ------(n=30)-----	p-value
Shivering score			0.045
3	5 (16.67%)	3 (10%)	
4	2 (6.67%)	1 (3.33%)	
Onset of shivering after spinal anaesthesia (min)	21.4±8.5	26.3±10.3	0.049

Table 4: Pattern of adverse effects

Adverse effects	Group T	Group D (n = 30)
Nausea	2 (6.67%)	0
Vomiting	2 (6.67%)	0
Sedation	3 (10%)	7 (23.33%)
Hypotension	3 (10%)	3 (3.33%)

as compared to tramadol (16%). Nausea and vomiting was found to be higher in the case of tramadol. On the other hand, dexmedetomidine caused moderate sedation (modified Ramsay sedation score = 3-4) from which the patient could be easily awoken up.

Bicer *et al.*^[16] showed that one dose of prophylactic administration of intraoperative dexmedetomidine ($1.0 \mu\text{g kg}^{-1}$) before the end of the surgery reduced vasoconstriction as well as shivering threshold. A study performed by Easley *et al.*^[17] showed that dexmedetomidine ($0.5 \mu\text{g kg}^{-1}$) was effective in treating post-anaesthetic shivering in children. Mittal *et al.*^[18] noted that although both drugs are effective, the time taken for cessation of shivering is less with dexmedetomidine when compared to tramadol. Moreover, dexmedetomidine has negligible adverse effects, whereas tramadol is associated with significant nausea and vomiting.

Wang *et al.*^[19] conducted a meta-analysis of randomized controlled trials, studied 13 randomized controlled trials including 864 subjects were included. Dexmedetomidine had higher effective rate of shivering control, shorter time to cease shivering, lower recurrent rate of shivering, lower incidences of nausea and vomiting, higher incidence of sedation, hypotension and bradycardia, compared with tramadol.

The limitations of this study were small sample size and selection of medium duration surgeries as the chance of developing core hypothermia are more in long duration surgeries. Tympanic membrane temperature probe and mid esophagus temperature probe could not be used to measure core body temperature because it causes patient discomfort who is awake under spinal anesthesia. Rectal temperature monitoring was a possibility however could not be attempted.

CONCLUSION

Intravenous dexmedetomidine had less incidence of intra-operative shivering, late onset of intra-operative shivering and lesser side effects when compared to tramadol for intra-operative shivering in patients undergoing surgery under subarachnoid blockade. Slight sedation with dexmedetomidine proves beneficial. Intravenous dexmedetomidine should be preferred than intravenous tramadol and thereby reduces patient discomfort.

REFERENCES

1. Chaturvedi, S. and G. Domkondwar, 2002. Control of shivering under regional anaesthesia using tramadol. *Asian Arch. Anaesthesiol. Resusc.*, 57: 491-496.
2. Buggy, D.J. and A.W.A. Crossley, 2000. Thermoregulation, mild perioperative hypothermia and post-anaesthetic shivering. *Br. J. Anaesth.*, 84: 615-628.
3. Shukla, U., K. Malhotra and T. Prabhakar, 2011. A comparative study of the effect of clonidine and tramadol on post-spinal anaesthesia shivering. *Indian J. Anaesth.*, 55: 242-246.
4. Venkatraman, R., K. Karthik, A. Pushparani and A. Mahalakshmi, 2018. A prospective, randomized, double-blinded control study on comparison of tramadol, clonidine and dexmedetomidine for post spinal anesthesia shivering. *Braz. J. Anesthesiol.*, 68: 42-48.
5. Park, S.M., H.S. Mangat, K. Berger and A.J. Rosengart, 2012. Efficacy spectrum of antishivering medications: Meta-analysis of randomized controlled trials. *Crit. Care Med.*, 40: 3070-3082.
6. Crossley, A.W.A. and R.P. Mahajan, 2007. The intensity of postoperative shivering is unrelated to axillary temperature. *Anaesthesia*, 49: 205-207.
7. Singh, M., S. Sahi and S. Katyal, 2016. Comparative efficacy of intravenous dexmedetomidine, clonidine, and tramadol in postanesthesia shivering. *J. Anaesthesiol. Clin. Pharmacol.*, 32: 240-244.
8. Kumar, V., D. Nirala, J. Prakash, B. Ram, P. Bhattacharya and S. Priye, 2020. Randomized double-blinded comparative study of intravenous nalbuphine and tramadol for the treatment of postspinal anesthesia shivering. *Anesthesia: Essays Res.es*, 14: 510-514.
9. Mathews, S., A.A. Mulla, P.K. Varghese, K. Radim and S. Mumtaz, 2002. Postanaesthetic shivering: A new look at tramadol. *Anaesthesia*, 57: 387-403.
10. Fern, L. and K. Misiran, 2015. Comparison of dexmedetomidine, pethidine and tramadol in the treatment of post-neuraxial anaesthesia shivering. *Southern Afr. J. Anaesth. Analg.*, 21: 14-18.
11. Bajwa, S.S., S. Bajwa, J. Kaur, G. Singh and V. Arora *et al.*, 2011. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. *Indian J. Anaesth.*, 55: 116-121.
12. Ameta, N., M. Jacob, S. Hasnain and G. Ramesh, 2018. Comparison of prophylactic use of ketamine, tramadol, and dexmedetomidine for prevention of shivering after spinal anesthesia. *J. Anaesthesiol. Clin. Pharmacol.*, Vol. 34, No. 352.
13. Singh, S., V.K. Verma, C. Prasad and J. Prakash, 2016. Randomised double-blind comparative study of dexmedetomidine and tramadol for prevention of perioperative shivering in transurethral resection of prostate under spinal anaesthesia. *J. Evol. Med. Dent.*, 5: 572-575.
14. Patil, A.J. and B.R. Sonawane, 2021. Prospective randomised study for comparison of intravenous tramadol and intravenous dexmedetomidine for the control of intraoperative shivering under spinal anaesthesia. *MedPulse Int. J. Anesthesiol.*, 17: 74-78.

15. Kundra, T., G. Kuthiala, A. Shrivastava and P. Kaur, 2017. A comparative study on the efficacy of dexmedetomidine and tramadol on post-spinal anesthesia shivering. *Saudi J. Anaesth.*, 11: 2-8.
16. Bicer, C., A. Esmoğlu, A. Akin and A. Boyacı, 2006. Dexmedetomidine and meperidine prevent postanesthetic shivering. *Eur. J. Anaesthesiol.*, 23: 149-153.
17. Easley, R.B., K.M. Brady and J.D. Tobias, 2007. Dexmedetomidine for the treatment of postanesthesia shivering in children. *Pediatr. Anesthesia*, 17: 341-346.
18. Mittal, G., K. Gupta, S. Katyal and S. Kaushal, 2014. Randomised double-blind comparative study of dexmedetomidine and tramadol for post-spinal anaesthesia shivering. *Indian J. Anaesth.*, 58: 257-262.
19. Wang, J., Z. Wang, J. Liu and N. Wang, 2020. Intravenous dexmedetomidine versus tramadol for treatment of shivering after spinal anesthesia: A meta-analysis of randomized controlled trials. *BMC Anesthesiol.*, Vol. 20, No. 104. 10.1186/s12871-020-01020-y