

# Control of Shivering with Butorphanol and Tramadol under Spinal Anesthesia - A Comparative Study

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## Abstract

**Introduction:** Shivering is a common occurrence in anesthesia practice. It is an involuntary, rhythmic and intermittent muscle contraction beginning in the head and neck, extending to the extremities and culminating in generalized shaking.

**Aim:** To compare the effectiveness of butorphanol and tramadol in control of post-spinal shivering.

**Methods:** This prospective randomized study was conducted in 40 patients who developed shivering under spinal anesthesia during various general surgical and urological procedures. On shivering, patients were randomly allocated to receive an intravenous, 1ml bolus dose of 50 mg tramadol or 1mg butorphanol. Control of shivering, time taken for cessation, recurrence and hemodynamic changes were noted and compared for both groups. Collected data were analyzed using appropriate statistical tests.

**Result:** A statistically significant abolition of shivering in 1 and 3 min was observed after administering butorphanol than tramadol. There was no significant difference in hemodynamic variations between both groups. Though both the groups showed an increase in heart rate and diastolic blood pressure during shivering it normalized after control of shivering.

**Conclusion:** Both butorphanol and tramadol were effective for relieving post-operative pain; Butorphanol had an edge over tramadol in controlling shivering with lower chances of recurrence.

**Key words:** Butorphanol, Perioperative shivering, Spinal anesthesia, Tramadol

## INTRODUCTION

Shivering, an involuntary oscillatory muscular activity, is a physiological response to core hypothermia in an attempt to raise the metabolic heat. Prolonged impairment of thermoregulatory autonomic control under anesthesia along with the cold environment of the operating room and cold infusion fluids, contribute to a fall in core body temperature and hence shivering.<sup>1,2</sup> Other known causes of shivering include transfusion reactions, drug

reactions, pre-existing high-grade fever or bacteremia, or infusion of contaminated intravenous (IV) fluids (fungal growth in dextrose containing fluids). Perioperative hypothermia is the most common cause of shivering. In a shivering patient, oxygen consumption may increase by 200-500% along with a linear increase in carbon dioxide production.<sup>3</sup> Thus in a patient with limited myocardial oxygen reserve or coronary disease, shivering may further compromise myocardial function.<sup>4</sup> Shivering also increases intraocular and intracranial pressure and may contribute to increased wound pain, delayed wound healing and delayed discharge from post-anesthetic care.<sup>2</sup> Apart from being an uncomfortable experience, its deleterious effects warrant primary prevention and prompt control on occurrence.

Various pharmacological therapies aim to prevent or treat shivering includes opioids (pethidine, nalbuphine, or tramadol), ketanserin, propofol, granisetron, doxapram,

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physostigmine, clonidine, and nefopam but debate on an ideal anti-shivering drug continues.<sup>2,5</sup> Tramadol hydrochloride, a  $\mu$ -opioid receptor agonistic drug, has a modulator effect on central monoaminergic pathways and thus inhibits the neuronal uptake of noradrenaline/serotonin and encourages hydroxytryptamine secretion which resets the body temperature regulation center. It has gained a reputation in many clinical trials for the control of shivering. Butorphanol an easily available opioid acts through kappa and mu receptor agonistic modulation.<sup>6</sup> This clinical trial was set out to compare the efficacy of butorphanol and tramadol for controlling perioperative shivering of surgical patients under spinal anesthesia. Secondary outcomes included perioperative variations in hemodynamic parameters and the incidence of adverse effects among the groups.

### Aim

To compare the effectiveness of butorphanol and tramadol in control of post-spinal shivering.

## MATERIALS AND METHODS

Patients with American Society of Anesthesiologists Physical Status I-II, posted for procedures (urological and general surgical procedures) under spinal anesthesia, who developed shivering during the intra- or post-operative period (up to 2 h), were included in the study. Patients with hypo or hyperthyroidism, morbid obesity (body mass index of  $\geq 40$  kg/m<sup>2</sup>), fever (axillary temperature  $>37^\circ\text{C}$ ) and compromised cardiorespiratory functions were excluded.

The cases were randomly allocated to two groups. Group T received an IV bolus of 50 mg (1 ml) tramadol. Group B received an IV bolus of 1 mg (1 ml) butorphanol.

In all cases, standard monitors were attached in the operating room, and baseline parameters were recorded. IV fluids infused were at room temperatures, and ambient temperature of the operating room and recovery room was maintained at 22-28°C. Spinal anesthesia was performed with a 25 or 26 G Quincke spinal needle, in a sitting position, at the L3-4 interspace with bupivacaine (0.5% heavy) in a dose of 2.4-3.2 ml, to achieve a desirable level of T6-8 dermatome, in accordance with the surgical procedure. After induction of spinal anesthesia, patients were observed for the occurrence of shivering until the post-operative period. The intensity of shivering was graded on a scale 0-3 as:

- 0=No shivering
- 1=Shivering in face and head (mild)
- 2=Visible tremors involving more than one group of muscles (moderate)

- 3=Gross muscular activity involving the entire body, bed shaking (severe).

Only cases that developed shivering of grade 2 or 3 during the perioperative phase were given treatment on an intention to treat basis. At the onset of shivering (grade 2 or 3), all patients were given oxygen via face mask at 5L/min and 1 ml of studied drug as per group allocation. Shivering control was defined as complete when post-treatment, the shivering score declined to 0, incomplete when the scores decreased but did not abolish the shivering completely and failed if no change in scores was observed.

The time taken for cessation of rigors and hemodynamic changes was recorded at regular 5 min intervals up to 20 min. Recurrence of shivering if any was noted and recorded and treated with pethidine in a dose of 0.5 mg/kg.

## RESULTS

Demographic data and duration of surgery were found to have no statistically significant difference between the groups. In the 1<sup>st</sup> min. after administration of the drugs, there was a significant relief in the abolition of shivering with butorphanol than tramadol. Only six patients in the tramadol group had relief whereas 14 patients in the butorphanol group had relief in the 1<sup>st</sup> min. There was a recurrence of shivering noted in one patient in the tramadol group after 20 min. whereas no such episodes were noted in the butorphanol group. No statistically significant change in heart rate or blood pressure (BP) was observed in both the groups for 20 min (Figure 1). A drop in systolic BP of around 10 mm Hg, an increase in diastolic BP and increase in heart rate was observed in both the groups during the onset of shivering (Figures 2 and 3). There were no reports of nausea and vomiting in any patient during the intra-operative period. Grade 1 sedation was observed in butorphanol treated groups whereas no sedation was noted with tramadol. No episode of respiratory depression was noted in both groups as oxygen was supplemented throughout the intra-operative period.

## DISCUSSION

Shivering presents as a common perioperative problem causing hypertension, tachycardia and increased metabolic demands. It also interferes with intra-operative monitoring of electrocardiogram, BP, and oxygen saturation. Various risk factors associated with shivering include type and duration of anesthesia, level of sensory blockade, age, temperature of the operating room, and infusion fluids.

In our study, butorphanol was quicker compared to tramadol in suppressing shivering whereas in the study

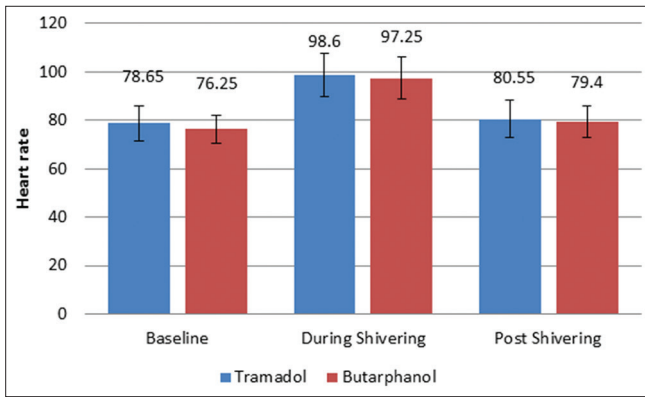


Figure 1: Mean heart rate at different time intervals two groups

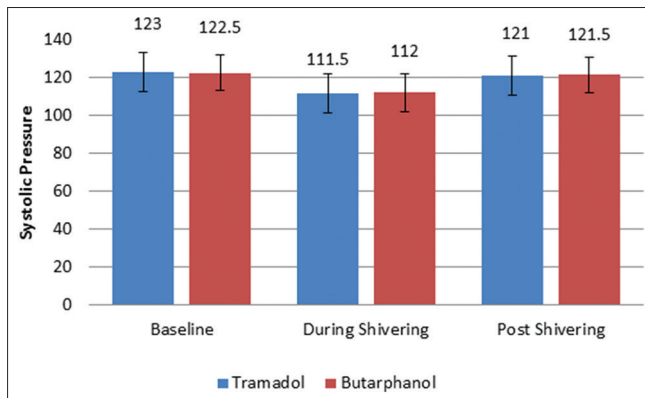


Figure 2: Mean systolic blood pressure at different time intervals in two groups

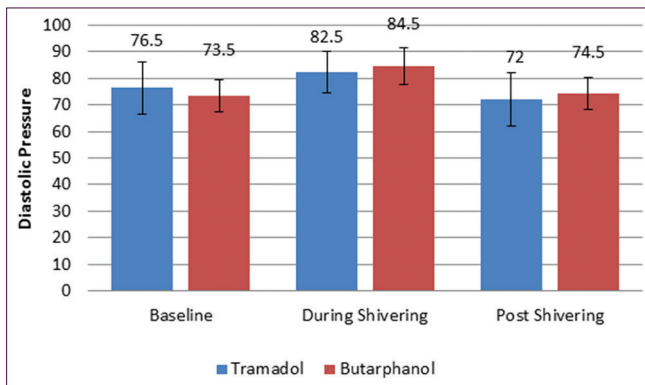


Figure 3: Mean diastolic blood pressure at different time intervals in two groups

conducted by Bansal and Jain.<sup>7</sup> The time taken for complete abolition of shivering in both the groups were almost same. One case of recurrence of shivering was observed in our study and none in butorphanol group which is in contrast to the observations made by Maheshwari *et al.* who observed a lower rate of recurrence with tramadol than butorphanol.<sup>6</sup>

Clonidine was found to be inferior to tramadol and butorphanol in the control of shivering with a higher rate of recurrence. A higher fall in systolic and diastolic BP and

an increase in heart rate was found in the clonidine group after treatment of shivering than in other two groups. In our study, we found a rise in diastolic BP and increase in heart rate during shivering which normalized after treatment with tramadol or butorphanol.<sup>7</sup>

Shukla *et al.* compared the effects of clonidine and tramadol in shivering control and found that shivering got controlled earlier with clonidine than tramadol. Two patients of clonidine group and one patient in tramadol group developed bradycardia. Three patients in clonidine group developed hypotension. No similar hemodynamic effects were observed in our study.<sup>8</sup>

Joshi *et al.* observed that tramadol and butorphanol were similar in their ability to control shivering under spinal anesthesia in contrast to our study where butorphanol was superior to tramadol, which was statistically significant. There was no difference in hemodynamic parameters in all the three groups pre-shivering, intra-shivering, or post-shivering whereas, in our study, we observed a rise in diastolic BP and heart rate during the onset of shivering.<sup>9</sup>

Butorphanol was quicker than pethidine in abolishing shivering successfully. Relapse is more in pethidine than butorphanol.<sup>10</sup>

## CONCLUSION

Butorphanol is superior to tramadol for the management of post-operative shivering due to higher rates of success, earlier onset of action and lesser recurrence with comparable safety. At present, opioids hold a high reputation as reliable anti-shivering agents, though the search for an ideal substitute still continues.

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