Section: Anesthesia

Original Research Article

# A HOSPITAL BASED PROSPECTIVE STUDY TO COMPARE THE RELATIVE EFFICACY OF INTRAVENOUSLY ADMINISTERED 1MG BUTORPHANOL AGAINST 0.5MG/KG KETAMINE TO CONTROL INTRA-OPERATIVE SHIVERING IN PATIENTS WHO RECEIVE SPINAL ANESTHESIA FOR VARIOUS SURGICAL PROCEDURES AT TERTIARY CARE CENTER

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## Abstract

**Background:** Shivering, an involuntary, oscillatory muscle activity is a physiological response to core hypothermia in an attempt to raise the metabolic heat production. Spinal anaesthesia is a popular and safe anesthesia technique for various surgeries. Therefore, in the search for a safer and more efficacious drug, in our study, we compared two easily available and safe drugs Butorphanol and Ketamine, administered intravenously for treating shivering in patients who received spinal anaesthesia for various surgical procedures. **Materials and Methods:** A hospital-based prospective study done on 80 patients posted for elective surgeries under spinal anaesthesia at K.D. Medical College, Mathura, U.P. during one year period. Those patients who developed intra-operative shivering following spinal anaesthesia were included in the study. Group I- Butorphanol group (will receive 1mg intravenous butorphanol) and Group II- Ketamine group (will receive 0.5mg/kg body weight of intravenous ketamine). Patients were monitored for time taken for cessation of shivering and hemodynamic changes including heart rate, blood pressure, oxygen saturation and temperature at intervals of 1 minute for 5 minutes and thereafter 10, 20 and 30 minutes till end of surgery. **Result:** 80 patients who developed shivering of grades 2 and above, were randomly allotted to either of the two groups. Both the groups had 40 patients. The mean temperature at which patients developed shivering was 36.83oC in Butorphanol group and 36.92oC in Ketamine group. Butorphanol controlled shivering in mean time of 138.83 sec while Ketamine controlled shivering in mean time of 156.55sec. There was no statistically significant difference between the two groups in terms of time required to control shivering (P>0.05). There were no failures or recurrences in either of the 2 groups. None of the patients in the Butorphanol group had nausea or vomiting while 1 patient in Ketamine group developed nausea, however, there was no statistically significant difference. There was no sedation in Butorphanol group while 13 patients had sedation of grade 2 in Ketamine group and this result was statistically significant (P <0.05*). **Conclusion:** In our study we conclude that both, Butorphanol 1mg and Ketamine 0.5mg/kg, are equally safe and effective in controlling shivering after spinal anaesthesia.

## INTRODUCTION

Spinal anaesthesia is a popular and safe anesthesia technique for various surgeries. Shivering is one of the most common complications of a central neuraxial blockade, due to impairment of the thermoregulatory control.[1] It has been reported in 40 to 70% of patients undergoing surgery under regional anesthesia.[2,3] Shivering that develops during spinal anaesthesia is a common problem and may occur in 19-33% of patients receiving spinal anaesthesia.[4]

Spinal anaesthesia is known to decrease the vasoconstriction and shivering thresholds. There is


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core to periphery redistribution of heat due to spinal induced vasodilatation and shivering is preceded by core hypothermia and vasoconstriction above the level of block.[5,6]

Shivering is unpleasant for the patient, anesthesiologist and the surgeon besides being physiologically stressful for the patient. The physiologic role of shivering is to provide heat, but its occurrence in relation to anaesthesia is inconsistent and incompletely understood.[7] Apart from being an uncomfortable experience, its deleterious effects warrant prompt control on occurrence. Shivering, an involuntary, oscillatory muscle activity is a physiological response to core hypothermia in an attempt to raise the metabolic heat production.[2]

Prolonged impairment of thermoregulatory autonomic control under anesthesia along with the cold environment of operating rooms and cold infusion fluids, contributes to a fall in core body temperature, and hence shivering.[2]

In a shivering patient, there is increase in metabolic activity, thus oxygen consumption may increase by 200%–500% along with a linear increase in carbon dioxide production.[8] Thus in a patient with limited myocardial oxygen reserve or known coronary disease, shivering may further compromise myocardial function.[5] Shivering also increases intraocular and intracranial pressure, and may contribute to increased wound pain, delayed wound healing, and delayed discharge from post anaesthetic care.[9]

Various pharmacological therapies aim to prevent or treat shivering include opioids (pethidine, nalbuphine, or tramadol), ketanserin, propofol, granisetron, doxapram, physostigmine, clonidine, and nefopam, but debate on an 'ideal anti-shivering drug'continues.[9,10] In a country like India, restrictions on drug licensing of opioids, and unavailability of many other drugs, compound the problem.[11]

Therefore, in the search for a safer and more efficacious drug, in our study, we compared two easily available and safe drugs Butorphanol and Ketamine, administered intravenously for treating shivering in patients who received spinal anaesthesia for various surgical procedures.

## MATERIALS AND METHODS

A hospital-based prospective study done on 80 patients posted for elective surgeries under spinal anaesthesia at K.D. Medical College, Mathura, U.P. during one year period. Those patients who developed intra-operative shivering following spinal anaesthesia were included in the study.

**Inclusion Criteria**

- Patients who developed shivering following spinal anaesthesia.
- Shivering of grade 2-3 (Crossley and Mahajan scale) lasting for a minimum period of 2 minutes.

**Exclusion Criteria**

- Surgeries lasting more than 4hours
- Patients who develop shivering even before administering spinal anaesthesia
- Patients with fevers, drug allergy, thyroid disease, abnormal psychological profile and neuromuscular diseases.
- Patients with severe systemic disorders like diabetes mellitus, hypertension, and obesity (body mass index of ≥ 40kg/m2, compromised cardiovascular and respiratory conditions.

**Methodology**

All patients underwent thorough pre-anaesthetic evaluation the day before surgery. Details of the spinal technique were explained to the patients. Patients were positioned on a flat operating table in sitting position and under strict aseptic precautions; L3-L4 interspace was identified. After 2ml of 2% lignocaine local anaesthetic skin infiltration, lumbar puncture was done using a 25G disposable Quincke spinal needle. After noting the clear and free flow of CSF, 0.5% hyperbaric bupivacaine 3-4 ml was injected into the subarachnoid space, the volume of which was decided depending upon the type of surgery. Patients were turned supine immediately and were given supplemental oxygen at 4L/minute via face mask. Surgery was allowed to commence when adequate sensory blockade was achieved.

After induction of spinal anaesthesia, patients were observed for occurrence of shivering, using Crossley and Mahajan3 scale.

As and when they develop shivering of grades 2-3 for a minimum of 2 minutes, the patients were randomly allocated to any one of the two study groups by using Block Randomization technique.

**Group I:** Butorphanol group (will receive 1mg intravenous butorphanol)

**Group II:** Ketamine group (will receive 0.5mg/kg body weight of intravenous ketamine)

Patients were monitored for time taken for cessation of shivering and hemodynamic changes including heart rate, blood pressure, oxygen saturation and temperature at intervals of 1 minute for 5 minutes and thereafter 10, 20 and 30 minutes till end of surgery.

Recurrence, if any, was also recorded until the patient leaves the operating room. Failure or recurrence of shivering would be treated with Inj. Tramadol 50mg i.v. Sedation was assessed on a 4-point scale using Ramsey's Sedation Score.

**Statistical Analysis:** Statistical methods like Chi-square test and Student's t test (unpaired and paired) were used to find the significance of homogeneity of study characteristics between the two groups of patients.

## RESULTS

Our study showed that the mean age of subjects in Butorphanol group was 36.87 years but the mean age of subjects in Ketamine group was 41.93 years and this difference was not statistically significant. Males


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were 60% and females were 40% in Butorphanol group whereas 46.7% were males and females were 53.3% among Ketamine group, which was not statistically significant. The comparison of mean weight was statistical non significant (P>0.05) [Table 1].

In present study showed that the ASA grade, type of surgery and shivering grade was statistical non-significant in between groups. The temperature was compared between two groups and it was observed that before shivering, the mean temperature in Ketamine group was slightly high (36.92oc) compared to Butorphanol group (36.83oc) and this difference was not statistically significant. At shivering, the mean temperature in both groups was comparable and almost same and it was not statistically significant. The mean time required to control shivering was high in Ketamine group compared to Butorphanol group but this difference was not statistically significant [Table 2].

The mean heart rate & mean DBP was high in Butorphanol group compared to Ketamine group and this difference was not statistically significant. The mean SBP & mean SPO2 was high in group Ketamine compared to Butorphanol group and this difference was not statistically significant [Table 3].

Nausea/Vomiting was observed only in Ketamine group (3.3%) but this was not statistically significant. The incidence of Sedation was found only in Ketamine group and it was 32.5%, and this difference was statistically significant (p<0.05*) [Table 4].

**Table 1: Comparison of demographic profile in between groups**

| Demographic profile | | Group I (Butorphanol group) (N=40) | Group II (Ketamine group) (N=40) | P- value |
|---|---|---|---|---|
| Age (yrs) (Mean±Sd) | | 39.26±10.62 | 43.58±12.05 | >0.05 |
| Gender | Male | 24 (60%) | 19 (47.5%) | >0.05 |
| | Female | 16 (40%) | 21 (52.5%) | |
| Weight (Kg) (Mean±Sd) | | 52.30±11.67 | 54.96±11.14 | >0.05 |

**Table 2: Comparison of clinical characteristics in between groups**

| Clinical Characteristics | Group I (Butorphanol group) (N=40) | Group II (Ketamine group) (N=40) | P- value |
|---|---|---|---|
| ASA Grade | | | |
| Type I | 32 (80%) | 27 (67.5%) | >0.05 |
| Type II | 8 (20%) | 13 (32.5%) | |
| Type of Surgery | | | |
| Abdominal Surgeries | 16 (40%) | 17 (42.5%) | >0.05 |
| Urological Surgeries | 5 (12.5%) | 8 (20%) | |
| Lower limb surgeries | 19 (47.5%) | 15 (37.5%) | |
| Shivering grade | | | |
| Grade 2 | 29 (72.5%) | 27 (67.5%) | >0.05 |
| Grade 3 | 11 (27.5%) | 13 (32.5%) | |
| Temperature (oC) | | | |
| Pre | 36.83±0.43 | 36.92±0.48 | >0.05 |
| At shivering | 36.62±0.41 | 36.68±0.40 | >0.05 |
| Time required for control shivering (in Sec.) | 138.83±60.13 | 156.55±62.26 | >0.05 |

**Table 3: Comparison of vitals at the time of shivering in between groups**

| Vitals | Group I (Butorphanol group) (N=40) | Group II (Ketamine group) (N=40) | P- value |
|---|---|---|---|
| Hear rate | 75.96±8.73 | 74.82±7.38 | >0.05 |
| SBP | 130.12±8.53 | 135.06±9.24 | >0.05 |
| DBP | 78.26±9.45 | 74.22±9.41 | >0.05 |
| SPO2 | 98.47±0.63 | 98.55±0.58 | >0.05 |

**Table 4: Distribution of patients based on Nausea/vomiting, Sedation, Itching, hallucination**

| Complications | Group I (Butorphanol group) (N=40) | Group II (Ketamine group) (N=40) | P- value |
|---|---|---|---|
| Nausea/Vomiting | 0 | 1 | >0.05 |
| Sedation | 0 | 13 | <0.05* |
| Itching | 0 | 0 | - |
| Hallucination | 0 | 0 | - |

## DISCUSSION

Spinal anaesthesia is a safe and popular anaesthesia technique used world over for various surgeries. Spinal anaesthesia is a type of central neuraxial blockade, the other commonly used technique being Epidural anaesthesia. The incidence of shivering in patients receiving regional anaesthesia is 19%-33%.[4,5] The physiologic role of shivering is to provide heat, but its occurrence in relation to anaesthesia is inconsistent and incompletely understood. The probable mechanism under regional anaesthesia could either be a result of decrease in core body temperature, misinformation from receptors or impairment of the physiological set points.[5]

The mechanism which leads to shivering is not very clear, but the probable mechanisms could be decrease in core body temperature secondary to sympathetic block; peripheral vasodilatation; increased cutaneous blood flow, which leads to increased heat loss


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through skin; cold temperature of operation theatre; rapid infusion of cold IV fluids; and effect of cold anesthetic drugs upon the thermosensitive receptors in the spinal cord.[12,13]

Pharmacological intervention does not raise body temperature, but resets the shivering threshold to a lower level, thereby decreasing rigors and its episodes. The neurotransmitter pathways involved in shivering are complex and involve opioids, adrenergic, serotonergic, and anticholinergic receptors. By virtue of this fact, drugs acting on these systems are utilized in treatment of this condition.[1]

Following spinal anaesthesia the mean temperature at which shivering occurred in patients in our study was 36.83oC among Butorphanol group and 36.920C among Ketamine group. This result was in accordance to study by Aditi Dhimar and associates.[14]

In our study shivering disappeared within 138.83 sec of drug administration in patients in the Butorphanol group while it took 156.55 sec in patients in Ketamine group, although there was no statistical significance between the two. This result was unlike that noted by Bhaarat and co-workers in their study.[15]

In our study, there were no significant differences in core body temperature pre operatively or intraoperatively and both drugs gave good hemodynamic stability throughout the course of study in all patients. We observed significant improvement in SpO2 values in both groups. This was at par with earlier studies by Aditi Dhimar,[14] and Bhaarat and co-workers,[15] which reported similar observations with respect to hemodynamics.

Earlier studies found high incidence of nausea and vomiting with both drugs and more so with Butorphanol.[14] They suggested slow i.v inj. would reduce the incidence of nausea and vomiting. In our study we injected drugs slow i.v in both groups for all cases. We observed 2.5% incidence of nausea and vomiting in patients receiving Ketamine while no such untoward incident with Butorphanol in contrast to study by Bhaarat.[15] There was however no statistical difference in the two groups.

In our study though both Ketamine and Butorphanol were equally effective in controlling shivering and they were similar with respect to parameters like time to control shivering, hemodynamic stability and recurrence of shivering. However, Butorphanol had no incidence of nausea and vomiting. Ketamine is known to cause hallucinations, but none of the patients complained of hallucination in any of the groups. However, sedation of grade 2 was observed in 32.5% of Ketamine group, which was statistically significant. This is in accordance with other studies.[8,16]

## CONCLUSION

We concluded that Ketamine and Butorphanol were equally effective in controlling shivering and they were similar with respect to parameters like time to control shivering, hemodynamic stability and recurrence of shivering.

## REFERENCES


1. Ozaki M, Kurz A, Sessler DI, Lenhardt R, Schroeder M, Moayeri A, et al. Thermoregulatory thresholds during spinal and epidural anesthesia. Anesthesiology 1994;81:282-8.
2. Jan De Witte, Daniel I. Sessler; Perioperative shivering, Physiology and Pharmacology; Anesthesiology 2002; 96:467-84.
3. Sessler DI, Ponte J. Shivering during epidural anesthesia. Anesthesiology 1990;72:816-21.
4. C K Koay, W Y Chan and M K Chin; Shivering during regional anesthesia and its control with Pethidine; Singapore Med J 1991;32:160-62.
5. Buggy DJ, Crossley AWA. Thermoregulation, mild perioperative hypothermia, and post-anaesthetic shivering. Br J Anaesth. 2000;84:615–628.
6. Vassilieff, Rosencher, Sessler et al; Shivering Threshold during Spinal Anesthesia Is Reduced in Elderly Patients; Anesthesiology: December 1995 ;83(6):1162-66.
7. Doufas AG; Consequences of inadvertent perioperative hypothermia. Best Pract Res ClinAnaesthesiol. 2003 Dec: 17(4): 535-49.
8. Dal D, Kose A, Honca M, Akinci SB, Basgul E, Aypar U. Efficacy of prophylactic ketamine in preventing postoperative shivering. Br JAnaesth. 2005;95:189–192.
9. Kranke P, Eberhart LH, Roewer N, Tramer MR. Pharmacological treatment of postoperative shivering: a quantitative systematic review of randomized controlled trials. Anesth Analg. 2002;94:453–460.
10. Zhang Y, Wong KC. Anesthesia and postoperative shivering: its etiology, treatment and prevention. Acta Anaesthesiol Sin. 1999;37:115–120.
11. Katyal S, Tewari A, et al. Shivering: anesthetic considerations. J Anaesth Clin Pharmacol. 2002;18:363–376.
12. Anne Miu Han Chan, Kwok Fu. Control of shivering under regional anesthesia in 1999;46(3):253-8.
13. Chaturvedi S, Domkondwar G. Control of shivering under regional anesthesia using Tramadol. Asian Archives of Anaesthesiology and Resuscitation 2002;57:491-6.
14. Crowley LJ, Buggy DJ. Shivering and neuraxial anesthesia. Reg Anesth Pain Med 2008 May- Jun;33(3):241-52.
15. Bhaarat S. Maheshwari, Shailesh K. Shah, Indu A. Chadha; Tramadol and Butrophanol For Control of Shivering: Randomised Double Blind Comparative Study; J Anaesth Clin Pharmacol 2008; 24(3): 343-46.
16. Sagir O, Gulhas N, Toprak H, Yucel A, Begec Z, Ersoy O. Control of shivering during regional anaesthesia: Prophylactic ketamine and granisetron. Acta Anaesthesiol Scan 2007; 51:44-9.




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