



Original Article

Management of Postoperative Shivering by Intravenous Ketamine: A Prospective Randomized Study

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Abstract

Background and aim: Postoperative shivering (POS) is one of the common problems following general anesthesia and may lead to multiple complications. The aim of this study was to evaluate the preventive effect of intravenous ketamine on postoperative shivering. **Materials and methods:** This randomized placebo-controlled double-blind clinical trial included 80 patients scheduled for elective ENT operations, randomly divided into two groups. Group I (ketamine group) received intravenous ketamine 0.5 mg/kg in 5 ml normal saline and Group II (placebo group) received 5 ml normal saline 30 minutes before the anticipated completion of surgery. Anesthesia was induced equivalently for all. Patients were observed for incidence and severity of shivering in postoperative period. **Results:** Postoperative shivering was seen in 6 patients (15%) in the ketamine group and 18 patients (45%) in the placebo group ($p < 0.05$). Severity of POS was also significantly lower in ketamine group ($p < 0.05$). **Conclusion:** Intravenous ketamine 0.5 mg/kg body weight, 30 minutes before the anticipated completion of surgery can be used for effective prevention of postoperative shivering after general anesthesia.

Key words: Ketamine, general anesthesia, postoperative shivering (POS)

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Introduction

Postoperative shivering (POS) is an accompanying part of general anesthesia, with an estimated rate up to 50%¹. It has different unpleasant and stressful consequences for patients undergoing surgery due to some physiological changes including increasing oxygen consumption, hypoxemia, lactic acidosis and hypercarbia². These changes, in addition to increasing intraocular and intracranial pressure, may complicate the recovery process during anesthesia and increase the wound pain³.

Several studies have investigated the underlying mechanisms of POS. Accordingly, thermoregulatory and non-thermoregulatory reactions are responsible in this regard⁴⁻⁶. So, different pharmacologic interventions were studied considering these reactions, but the precise origin of it is not yet to be understood clearly⁷.

Various drugs have been investigated for prevention or treatment of postoperative shivering^{8,9}, including pethidine¹⁰⁻¹², alfentanil¹³, tramadol¹⁴, nefopam¹⁵, doxapram¹⁰, clonidine^{16,17} and metamizol¹⁸. Among

the pharmacological agents, pethidine has been shown to be one of the most effective treatments^{11,12,19}. Although its mechanism of action is not completely understood, it probably acts directly on the thermoregulatory center or via opioid receptors⁸. It is likely that N-methyl-D-aspartate (NMDA) receptor antagonists also modulate thermoregulation at multiple levels⁸. Ketamine, which is a competitive NMDA receptor antagonist, has been shown to inhibit postoperative shivering^{11,12,20}.

The aim of this study was to assess the prophylactic effect of ketamine in preventing postoperative shivering in patients under general anesthesia.

Materials and Methods

This is a randomized controlled double-blind study conducted from July to September 2018 in National Institute of ENT Dhaka. The inclusion criteria were American Society of Anesthesiologists (ASA) physical status I and II, need for general anesthesia with endotracheal intubation, not being addicted to any drugs, being 20–50 years of age. The exclusion criteria were hepatic or renal impairment,

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hypertension, cardiac ischemia, pulmonary and metabolic diseases. All participants provided written informed consent to participate in the study.

Preoperative evaluation included through physical examination. A complete blood test, renal function tests, liver function tests, chest x-ray and electrocardiogram were conducted on all patients. Routine monitoring was conducted after patients arriving in operating room with a monitor. A 20G cannula was inserted to the dorsum of left hand of the patient and Ringer's Lactate solution was started at a rate of 100ml/hour.

Eighty patients were randomly divided into two groups each containing 40 patients. Group I (Ketamine group) received intravenous ketamine 0.5 mg/kg in 5 ml normal saline and Group II (Placebo group) received 5 ml normal saline 30 minutes before the anticipated completion of surgery. The same standard protocol was used for anesthetic management of patients in both groups. Vital signs, oxygen saturation, electrocardiography, noninvasive blood pressure, pulse oximetry and end-tidal carbon dioxide were started to record when patient arrives in operation room. Anesthesia was induced using IV fentanyl 2 mcg/kg, propofol 2 mg/kg and vecuronium 0.1 mg/kg. After orotracheal intubation, anesthesia was maintained with nitrous oxide 60% in oxygen and halothane. Residual neuromuscular blockade was antagonized using 0.04 mg/kg neostigmine and 0.02 mg/kg atropine at the end of the surgery. During surgery IV fluid warming was not used. The operating room temperature was set at 22-24°C. After completion of surgery, the trachea was extubated when the patient had adequate respiratory efforts and properly responded to verbal commands. Then patients were shifted to recovery room and postoperative shivering was evaluated by shivering scale validated by Crossley & Mahajan²¹ and Tsai & Chu²².

Grading scale of postoperative shivering validated by Crossley & Mahajan²¹ and Tsai & Chu²²:

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 generalized shivering.

4= Shivering involving the whole body.

Statistical analysis: Quantitative data were expressed as the mean±standard deviation (SD). Qualitative data were expressed as frequency and percentage. Independent samples t-test of significance was used when comparing between two means. Chi-square test of significance was used in order to compare proportions between two

qualitative parameters. The p-value <0.05 was considered significant.

Results

There was no significant difference in terms of age, body weight, sex, ASA status, hemodynamics and body temperature between the groups (Table-I).

Table-I: Demographic and operative details of patients between Ketamine and placebo group

Demographic details	Group I (Ketamine group) n=40	Group II (Placebo group) n=40
Age (Years)	38.4±7.7	37.7±7.3
Weight (Kg)	64.23±7.14	66.54±7.72
Sex M/F	23/17	22/18
ASA physical status	36/4	37/3
Mean basal heart rate (bpm)	80.4±8.6	78.8±7.2
Mean basal systolic BP (mm Hg)	122.77±9.72	124.73±8.32
Mean basal diastolic BP (mm Hg)	83.87±7.86	82.64±9.83
Mean duration of surgery (min)	74.6±7.8	76.6±8.8
Mean body temperatures during surgery (°C)	36.18±0.36	36.20±0.24
Mean body temperature in recovery room (°C)	36.39±0.43	36.37±0.38

Table-II: Incidence and severity of post-operative shivering

Postoperative shivering (POS)	Group I (Ketamine group) n=40	Group II (Placebo group) n=40	p-value
Incidence of POS number (%)	6 (15%)	18 (45%)	p<0.05
Grading of POS	Number (%)		p-value
0	34 (85%)	22 (55%)	p<0.05
1	5 (12.5%)	9 (22.5%)	p<0.05
2	1 (2.5%)	6 (15%)	p<0.05
3	0	3 (7.5%)	p<0.05
4	0	0	-

In group I six (15%) out of the 40 patients had postoperative shivering (POS), whereas 18 (45%) out of the 40 patients had POS in group II (p<0.05). Grade 1 POS was lower number of patients in group

I when compared with group II (5 versus 9; $p < 0.05$). Grade 2 POS was also lower number of patients in group I when compared with group II (1 versus 6; $p < 0.05$) and grade 3 POS was only present in group II (0 versus 3; $p < 0.05$). There was no grade 4 POS in either of the two groups (Table-II, Figure-1). The baseline values of systolic and diastolic blood pressure and heart rate and temperature in both groups were similar and there was no adverse effect.

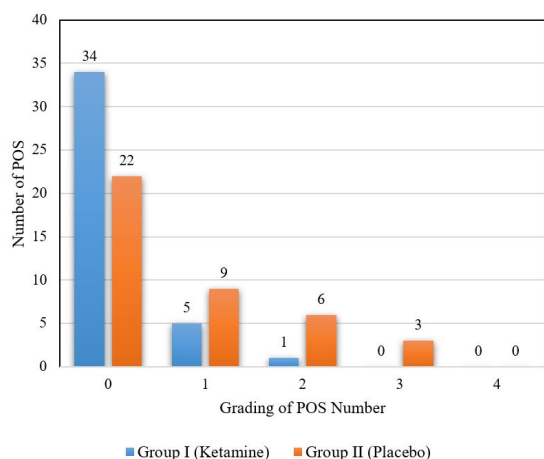


Figure-1: Severity of postoperative shivering in Group I and Group II

Discussion

Postoperative shivering (POS) is one of the most common problems in the early recovery phase following general anesthesia. Several medications have been suggested for the prevention and treatment of postoperative shivering.

The present study showed valuable preventive effect of ketamine on postoperative shivering compared to placebo group, here in ketamine group six (15%) out of the 40 patients had postoperative shivering, whereas 18 (45%) out of the 40 patients had POS in placebo group ($p < 0.05$). Grade 1 POS was lower number of patients in ketamine group when compared with placebo group (5 versus 9; $p < 0.05$). Grade 2 POS was also lower number of patients in ketamine group when compared with placebo group (1 versus 6; $p < 0.05$) and grade 3 POS was only present in placebo group (0 versus 3; $p < 0.05$). There was no grade 4 POS in either of the two groups.

Ramalingaraju et al.¹¹ revealed that 14.9% patient had postoperative shivering after general anesthesia using ketamine as pretreatment, that result is identical to present study.

A study done by Zavareh et al.¹² about prevention of postoperative shivering using ketamine, dexamethasone and pethidine. They recorded 37.8%

patients had postoperative shivering in ketamine group which is much higher than the present study. Another study done by Dal et al.²³ on prevention of postoperative shivering using ketamine as pretreatment agent and found 10% patients had shivering.

Though the different study showed different results on prevention of postoperative shivering using ketamine as pretreatment agent, but every study found significant reduction of postoperative shivering after administration of ketamine.

Conclusion

Use of intravenous ketamine 0.5 mg/kg body weight, 30 minutes before the anticipated completion of surgery could effectively decrease the incidence and severity of postoperative shivering.

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