

Comparison Between Two Different Doses of Intravenous Ketamine for Prevention of Post Operative Shivering in Patients Undergoing Surgeries Under Subarachnoid Block

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Abstract

Background and Aims: Perioperative hypothermia and shivering is among the unwanted, recurrent health issues in surgical patients undergoing both general and regional anaesthesia. Recently ketamine, has been reported with better results in prevention of shivering during anaesthesia.

This study compares 2 different doses of ketamine for prevention of post operative shivering in patients undergoing subarachnoid block.

Results: This study compared the efficacy of ketamine at doses of (0.25 mg/kg i. v.) and (0.5mg/kg i. v.) for prevention of shivering during spinal anaesthesia. Out of 240 patients, the number of patients with post operative shivering on arrival in the recovery room, and then 10

min after arrival, were significantly less in K1 (n=120) than in K2(n=120). In K1, 10 % patients shivered at grade >2 and were subsequently treated with tramadol 1mg/kg iv. In K2, 36.7% patients reached grade >2. (P< 0.05 was considered as statistically significant.

Conclusion: We conclude that prophylactic dose of Ketamine 0.5 mg/kg i. v. is better than ketamine 0.25 mg/ kg i. v. for prevention of shivering in patients, undergoing surgical procedures under spinal anaesthesia.

Keywords: ketamine, subarachnoid block, tramadol, spinal anaesthesia, core temperature.

Introduction

Shivering is defined as an involuntary, repetitive activity of skeletal muscles. The mechanisms of shivering in patients undergoing surgery are mainly intraoperative

heat loss, increased sympathetic tone, pain, and systemic release of pyrogens.⁶ The combination of Anaesthetic induced thermoregulatory impairment and exposure to the cool operation theatre environment, makes most unwarmed surgical patients hypothermic.⁵

Unintentional hypothermia, defined as central blood temperature below 36o C, often occurs during anaesthesia and surgery due to various factors. The main ones are the direct inhibition of thermoregulation by Anaesthetic, decreased metabolism, patient exposure to cold environment of operating rooms, and body cavity exposure ¹ There is evidence that perioperative hypothermia is associated with severe outcomes.

Increased incidence of wound infection, greater intra operative blood loss, need for blood transfusion, increased incidence of cardiac events, long-acting drugs, post operative shivering, increase post - Anaesthetic recovery, greater adrenergic activation, and increased incidence of thermal discomfort are associated with hypothermia.²

Spinal anaesthesia significantly impairs the thermoregulation system by inhibiting tonic vasoconstriction, which plays a significant role in 3 regulations.⁷

Spinal anaesthesia also causes redistribution of core heat from the trunk (below the block level) to the peripheral tissues. These two effects predispose patients to hypothermia and shivering.⁸ The median incidence of shivering related to regional anaesthesia observed in a review of 21 studies is 55%.⁶ Shivering increases oxygen consumption, lactic acidosis, carbon dioxide production, and metabolic rate by up to 400 %. ^{9, 10} It may also hamper monitoring of electrocardiogram (ECG), non-invasive blood pressure (NIBP), pulse oximetry etc.

Therefore, shivering may cause problems in patients with low cardiac and pulmonary reserves.

The best way to avoid these intraoperative and post operative shivering-induced increases in hemodynamic and metabolic demands is to prevent shivering in the first place.⁶ Shivering is a common complication, which appears in the post operative period following a general anaesthesia or neuraxial block. There are specific evaluation scales for assessing its intensity. The best known are the Crossley and Mahajan Scale and the Mathew Scale.

The Crossley and Mahajan Scale (Table 1) evaluates the intensity of the shivering through the observation of peripheral Vaso constriction, peripheral cyanosis and type of muscular activity.³ The Mathew Scale evaluates rather the fasciculations of face and neck and the intensity of muscular activity.⁴

The Crossley Scale

Table 1: The Crossley and Mahajan Scale.

Grade	Clinical description
0	No shivering
1	One or more of the following: piloerection, peripheral vasoconstriction, peripheral cyanosis with no other cause, but no muscle activity
2	Visible muscular activity confined to one muscle group
3	Visible muscular activity in more than one muscle
4	Gross muscular activity involving the whole body

Universally lots of attempts have been made to treat shivering rather than prevent it. Drugs like Pethidine, Tramadol, Clonidine, Magnesium Sulphate (MgSO4) etc. have been tried in the treatment of shivering. There is no gold standard drug for the prevention and treatment of shivering. Most of the drugs which are effective, like

Pethidine and Tramadol have serious side effects like respiratory depression, bradycardia, hypotension, etc. Also, these drugs are not easily available.

Ketamine, a competitive N-methyl D Aspartate (NMDA) receptor antagonist, has been recently tried in the prevention of shivering. It is likely that NMDA receptor antagonist modulate thermoregulation at various levels. This drug which is commonly used as an intravenous inducing agent, also has analgesic and local Anaesthetic properties.¹¹

As the dictum says, “prevention is better than cure” it holds good for Shivering too. Hence, an attempt has been made to compare the effectiveness of 0.25mg/kg and 0.25 mg/kg of Ketamine given prophylactically, 20 min before the end of surgeries under subarachnoid block, in the prevention of post-operative shivering.

Aims and objectives

The observational study aims to compare the effectiveness of 0.5 mg/kg and 0.25mg/kg doses of intravenous ketamine in the prevention of post-operative shivering after spinal anaesthesia.

Both the groups were compared for perioperative core temperature at different time intervals.

Materials and methods

A prospective observational study entitled “Comparison between two different doses of intravenous ketamine for prevention of post-operative shivering in patients undergoing surgeries under subarachnoid block” was undertaken in Government Medical College, Thrissur during the period of January 2019 to December 2019 after obtaining institutional ethical committee clearance.

A total of 240 patients belonging to American Society of Anaesthesiologist Physical Status (ASA-PS) class I and II, aged 18-60years undergoing surgeries under spinal anaesthesia.

Inclusion criteria

ASA grade I and II patients of both genders aged 18-60 years undergoing spinal Anaesthesia in government medical college Thrissur during the study period.

Exclusion criteria

Body Mass Index (BMI) more than 30kg/m² History of convulsions Multiple drug allergies

Thyroid disorder, severe cardiopulmonary disease, requiring transfusion of blood and blood products, endoscopic urological procedures, pregnancy, surgery for any infective etiology.

Study procedure After obtaining approval from institutional ethical committee pre - Anaesthetic evaluation was done by taking history and clinical examination. A written informed consent was obtained from these patients.

In all the patients, age, weight, basal heart rate, and blood pressure were measured and recorded. Investigations like complete blood count, urine for albumin, sugar and microscopy was done. Blood sugar, electrocardiogram and chest x-ray were performed. Patients were given 0.25 mg/kg & 0.5 mg/kg for control of post-operative shivering based on the preference of the anaesthesiologist as both doses are approved for the same (the recommended dose for prevention of shivering is between 0.25-0.75mg/kg)

The investigator had no opinion on the decision of dose selection and as an observer, selected 240 patients into two groups - Group K1 (who received Ketamine 0.5mg/kg) and Group K2 (who received ketamine 0.25mg/kg) of 120 numbers each based the dose planned.

Intravenous line was secured using 18-gauge IV cannula. Monitors like pulse oximeter, ECG and NIBP were attached. Base line core temperature of the patient was recorded. Under all aseptic precautions subarachnoid

block was given in lateral position in L3-L4 space with Quincke spinal needle of 23G. After confirming free and clear flow of CSF, Inj. bupivacaine 0.5% (heavy) was injected. Supine position was given. A standard double layer bed sheet was used to cover the chest and upper limb of all patients.

Patients belonging to group K1 received 0.5 mg/kg of Inj ketamine and group K2 received 0.25 mg/kg of Inj. Ketamine IV 20 minutes before the end of procedure. Each of these drugs were administered in 5 ml syringes which were made into a volume of 5 ml.

The duration of surgery was noted. Another reading of core body temperature was recorded. An anaesthesiologist not aware of the study was asked to observe the patient in the recovery room for shivering and other complications like nausea, vomiting etc.

Shivering was graded using four-point scale.

Grade 0 – No shivering

Grade 1: piloerection or peripheral vasoconstriction but no visible shivering;

Grade 2: muscular activity in only one muscle group;

Grade 3: muscular activity in more than one muscle group but not generalized; Grade 4: shivering involving the whole body.

Patients were observed every 10 minutes for one hour postoperatively, for the occurrence of shivering. The observations made were recorded.

If the patients shivered to at least grade 3, shivering was considered significant and prophylaxis as ineffective. Injection Tramadol 1 mg/kg IV slowly was given as a rescue analgesic agent.

Patients with nausea or vomiting were treated with Inj. Ondansetron 4 mg slow IV and those who developed hallucinations were treated with Midazolam 0.04 mg/kg IV.

Results

The results obtained from both the groups of patients (K1 and K2) were coded and entered in Excel. Categorical and quantitative variables were expressed as frequency (percentage) and mean \pm SD respectively. Independent t test was used to compare quantitative parameters between categories. Mann Whitney U test was used to compare ordinal variables between treatment groups. Chi-square test was used to association categorical variables with treatment group. For all statistical interpretations, $p < 0.05$ was considered the threshold for statistical significance. Statistical analyses was performed by using a statistical software package SPSS, version 20.0

Comparison of temperature at different time Interval between groups

Duration of surgery was compared between Group K1 and Group K2. The mean duration of surgery in Group K1 was 93.4 ± 23.6 minutes and that in Group 2 was 93.8 ± 23.5 minutes. Duration of surgery among two groups were compared using independent t test and the p value was calculated as 0.891 which was not found to be of statistical significance.

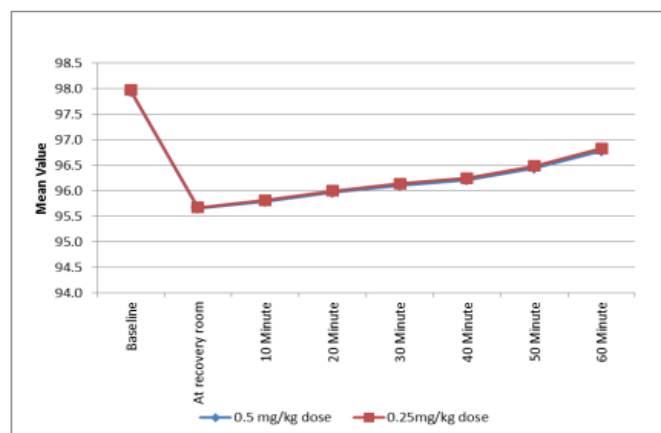


Figure 1: Comparison of temperature at different time interval between groups.

Both the groups (K1 and K2) were compared for perioperative core temperatures different time intervals i.e., every 10 min from recovery room till 60min. Baseline core temperatures of two groups were comparable. The groups showed highest temperature initially and then decreased by 2.50 F and then gradually increased over time.

Comparison of shivering at different time Interval between groups

2 groups were compared for shivering at different time intervals from recovery room (0 min) till 60 min every 10min. In group K1(0.5 mg/kg), 78.3% patients did not shiver or had grade 0 shivering while 10% patients had grade 3 shivering at 0 min. In group K2 (0.25 mg/kg), 52.5% patients did not shiver or had grade 0 shivering while 36.7% patients had grade 3 shivering at 0 min.

At 10min, in group K1, 83.3 % patients did not shiver or had grade 0 shivering and 10% patients had grade 3 shivering. While in group K2, 55.8% patients did not shiver or had grade 0 shivering 36.7% patients had grade 3 shivering at 10min.

Table 2: Comparison of shivering at 10 minutes between groups.

Shivering at 10 minutes	0.5 mg/kg dose		0.25mg/kg dose		Mann-Whitney U	p
	Count	Percent	Count	Percent		
Grade 0	100	83.3	67	55.8	4.87	p<0.01
Grade 1	8	6.7	7	5.8		
Grade 2	0	0.0	2	1.7		
Grade 3	12	10.0	44	36.7		

Table 3: Comparison of shivering at 30 Minute between groups.

Shivering at 30 Minute	0.5 mg/kg dose		0.25mg/kg dose		Mann-Whitney U	p
	Count	Percent	Count	Percent		
Grade 0	119	99.2	114	95.0	1.91	0.056
Grade 1	1	0.8	6	5.0		

After 10min, all the patients who had significant shivering (grade 3 or more) were given rescue drug tramadol 0.5mg/kg. In group K1 10% patients required rescue drug and in group K2, 36.7 % patients required rescue drug.

Table 4: Comparison of shivering at 40-60 min between groups.

Shivering		Control		Case	
		Count	Percent	Count	Percent
40 Minute	Grade 0	120	100.0	120	100.0
50 Minute	Grade 0	120	100.0	120	100.0
60 Minute	Grade 0	120	100.0	120	100.0

Comparison of Rescue drug supplementation in each group.

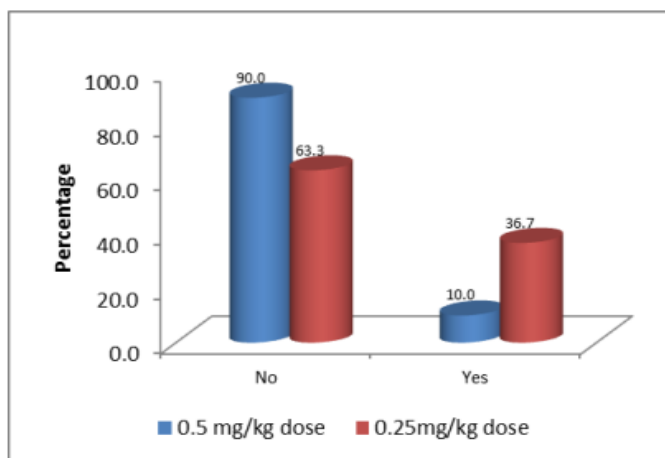


Figure 2: Comparison of rescue drug supplementation based on group

Discussion

Various drugs have been used to treat or prevent postoperative shivering, but the ideal treatment has not yet been found. Ketamine an N Methyl d aspartate receptor antagonists have potential for prevention of postoperative shivering. Ketamine at doses between 0.25-0.75 mg/kg iv is an effective way of preventing postoperative shivering.

Rupwate et al studied 120 patients who were scheduled to undergo infra umbilical surgeries under spinal anaesthesia and distributed them in to 3 groups containing 40 patients each. Group K, group O and group P who received inj ketamine 0.25 mg/kg iv, 0.5 mg/kg iv and placebo respectively 20 min prior to the end of surgery & shivering in all 3 groups were compared and side effects were also compared. The findings of the study suggest that prophylactic administration of injection Ketamine at doses of 0.25 mg/kg and 0.5 mg/kg was producing a significant anti shivering effect but an incidence of sedation and hallucination was observed in the Ketamine 0.5 mg/kg receiving group throughout the perioperative period. In conclusion, prophylactic dose of Ketamine 0.25 mg/kg i. v. is preferred over ketamine 0.5 mg/kg i. v. for

prevention of shivering in patients, undergoing surgical procedure under spinal anaesthesia, with lesser side effects.¹²

In the present study, 240 patients undergoing surgeries under subarachnoid block were observed in Government medical college, Thrissur. 240 patients were divided into two groups - Group K1 (who receive Ketamine 0.5mg/kg) and Group K2 (who receive ketamine 0.25mg/kg) of 120 numbers each. Ketamine was administered iv 20min before the end of the surgery. In study by Rupwate et al, all the three groups (groups K, O, P) were comparable, in view of demographic parameters, including age, weight, height and body mass index. Statistically, there was no significant difference. Sex ratio, ASA class were also compared and all the three groups were comparable. Statistically, there was no statistically significant difference.¹²

Duration of surgery was compared between Group K1 and Group K2. The mean duration of surgery in Group K1 was 93.4 ± 23.6 minutes and that in Group 2 was 93.8 ± 23.5 minutes. Duration of surgery among two groups were compared using independent t test and the p value was calculated as 0.891 which was not found to be of statistical significance.

In the study by Rupwate et al, all the three groups (group K, O, P) were compared for perioperative core temperature at different time intervals. Baseline core temperatures of all the three groups were comparable. The groups showed highest temperature initially. Difference was statistically significant in all the three groups, at all-time intervals except at baseline core temperature. Fall in core temperature was observed in all the groups (ketamine 0.5mg/kg, ketamine 0.25 mg/kg, placebo), as compared to baseline values, but it is less in patients receiving Inj Ketamine.¹²

In the study, both the groups (K1 and K2) were compared for perioperative core temperatures different time intervals i.e., every 10 min from recovery room till 60min. Baseline core temperatures of two groups were comparable. The groups showed highest temperature initially and then decreased by 2.50 F and then gradually increased over time. But no significant difference between two groups were observed at different intervals. From the results of study by Rupwate et al, they found that incidence of significant shivering in control group (placebo) was 42.5% and in Inj Ketamine 0.5 mg/kg group is 2.5%.¹²

In the present study, Tables showed comparison of shivering at different time intervals from recovery room (0 min) till 60 min every 10min. In group K1 (0.5 mg/kg), 78.3% patients did not shiver or had grade 0 shivering while 10% patients had grade 3 shivering at 0 min. In group K2 (0.25 mg/kg), 52.5% patients did not shiver or had grade 0 shivering while 36.7% patients had grade 3 shivering at 0 min.

At 10min, in group K1, 83.3 % patients did not shiver or had grade 0 shivering and 10% patients had grade 3 shivering. While in group K2, 55.8% patients did not shiver or had grade 0 shivering 36.7% patients had grade 3 shivering at 10min.

After 10min, all the patients who had significant shivering (grade 3 or more) were given rescue drug tramadol 0.5mg/kg. In group K1 10% patients required rescue drug and in group K2, 36.7 % patients required rescue drug.

Conclusion

In our study, we compared the effect of 2 doses of IV ketamine (0.5mg/kg and 0.25 mg/kg) in prevention of post operative shivering in patients undergoing surgeries under sub arachnoid block. We conclude that 0.5 mg/kg

iv ketamine is better than 0.25mg/kg in prevention of postoperative shivering in surgeries performed under sub arachnoid block.

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