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The Effectiveness of Prophylactic Use of Intravenous Ketamine and Tramadol in Control of Shivering and Their Side-Effects

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Abstract **Original Research Article**

Background and Aims: Shivering is a common problem during neuraxial anaesthesia. Neuraxial anaesthesia impairs thermoregulatory control and can occur in as many as 40%–70% of patients after regional anesthesia. This shivering, apart from its physiological and hemodynamic effects, has been described as even worse than surgical pain. The aim of the study was to evaluate the effectiveness of prophylactic use of intravenous ketamine, clonidine and tramadol in control of shivering and to note any side-effects of the drugs used. ***Material and Methods:*** A total number of 90 ASA I and II patients of either sex belonging to age group 18-60 years posted for Lower Abdomen and Lower Limb surgeries were divided into three groups of 30 each. Group P (control group): Patients received 10mL of normal saline IV as placebo. Group K: Patients received Inj. Ketamine 0.5mg/kgBW IV diluted to 10ml in Normal Saline. Group T: patients received Inj. Tramadol 0.5mg/kgBW IV diluted to 10ml in normal saline. ***Results:*** Shivering after spinal anesthesia was comparatively better controlled in group receiving Ketamine 0.5mg/kg and tramadol 0.5mg/kg as compared to control group (P<0.05). ***Conclusion:*** We conclude that giving Ketamine 0.5mg/kg, tramadol 0.5mg/kg i.v. prophylactically just before subarachnoid block significantly decreased the incidence of shivering without causing any major side effects. Using ketamine may be more beneficial as it improves the hemodynamic profile by its sympathomimetic effects and it sedates the patient effectively, which increases patient comfort during surgery, maintains cardio-respiratory stability and prevents recall of unpleasant events during the surgery.
Keywords: Ketamine, shivering, spinal anesthesia.

INTRODUCTION

Inadvertent hypothermia is associated with numerous adverse outcomes in the postoperative period. Shivering is an important complication of hypothermia; it is a complicated response of the body that includes at least three different patterns of muscular activity [1]. It occurs frequently i.e. 40 to 60% after volatile anaesthetic, but still it remains poorly understood. Obvious etiology although is said to be cold induced, but some shivering like tremors are not thermoregulatory [2, 3].

The processes that lead to core hypothermia in regional and general anaesthesia are similar [4]. As in general anaesthesia, the initial hypothermia in regional anaesthesia results from redistribution of body heat from the core to the periphery [5]. Shivering occurs in approximately 40% of unwarmed patients who are recovering from general anaesthesia and in about 50% of patients with a core temperature of 35.5 degree centigrade and in 90% of patients with a core temperature of 34.5 degree centigrade. It is associated with substantial adrenergic activation and discomfort [6].

Shivering should first of all be prevented, thereby offsetting hypothermia. If it does occur, it is treated, mainly by warming the patient and then administering medication to inhibit it. The benefits of cutaneous warming in the postoperative patients have been controversial, with some studies identifying benefits [7] and others failing to confirm faster rewarming [8]. Two factors contribute to rapid intraoperative transfer of heat from core to peripheral tissues, the first is vasodilatation induced by central inhibition of thermoregulatory control [9, 10], and the second is that general anaesthesia itself induces peripherally mediated vasodilatation, which facilitates intracompartmental heat transfer. Taken together, these studies suggest that intraoperative cutaneous warming is faster than comparable postoperative warming. It seems clear that patients should be warmed during surgery rather than allowed to cool and then rescued postoperatively for prevention of post anaesthesia

shivering. Cutaneous heat loss can be decreased by covering the skin (e.g. with surgical drapes, blankets or plastic bags). A single layer of an insulator reduces the heat loss by approximately 30%; unfortunately adding additional layers does not proportionately increase the benefit [11]. In most cases some form of active warming is required to prevent hypothermia. Forced air warming is generally the most effective available method [12], but any method or combination of methods that maintain the core temperature above 36.0°C is adequate. Forced air warming or a combination of forced air warming along with fluid warming is required to maintain normal intraoperative and postoperative core temperatures.

MATERIALS AND METHODS

This observational study was conducted in the department of anaesthesiology and critical care in Hospital for bone and joint surgery Barzulla and SMHS Hospital (associated hospitals of Government Medical College, Srinagar). The study observed the effects of Prophylactic Ketamine and Tramadol for control of shivering under subarachnoid block. The study was conducted after approval by the Institutional Ethical Committee and an informed written consent was obtained from all the patients for participation in this study.

Patients selected for surgery were among those already admitted in different units of the hospital. Pre-anaesthetic evaluation was done at least 24hrs prior to surgery. A thorough history including history of previous anaesthetic exposure, medication, personal habits, and allergy to any drugs was inquired about. General physical examination cardiovascular system, respiratory system, central nervous system and local examination of spine were performed. Airway assessment was done to predict difficult intubation. Routine investigations (CBC, LFT, KFT, Blood sugar (R/F), BT, CT, Chest radiograph, ECG, Serum electrolytes, Urine R/E) were asked for. In addition, all patients' weight and height were measured.

Sample Size

A total number of 90 ASA I and II patients of either sex belonging to age group 18-60 years posted for Lower Abdomen and Lower Limb surgeries were divided into three groups of 30 each.

Preoperative

All the patients were kept fasting 6 hrs prior to surgery. On the day of surgery in the operating room patients were connected to multichannel monitor and baseline heart rate, non-invasive Blood pressure, respiratory rate, oxygen saturation, electrocardiogram were recorded. Intravenous line was established with 18G size intravenous cannula. All the patients were given antiemetic inj palonosetron (0.075mg), inj. Pantoprazole 40mg and lactated ringer solution 10ml/kg bodyweight within half an hour prior to subarachnoid block. The drug under observation was administered by intravenous (i.v) route just before giving the block. The observational drug, saline and I/V fluids will be pre heated to 37 ^{0}C before administering them to the patients.

Study Groups

Patients were divided into three groups. Each group consisted of 30 patients as follows:

Group P (control group): Patients received 10mL of normal saline IV as placebo.

Group K: Patients received Inj. Ketamine 0.5mg/kgBW IV diluted to 10ml in Normal Saline.

Group T: patients received Inj. Tramadol 0.5mg/kgBW IV diluted to 10ml in normal saline.

Intraoperative

The temperature of the OT was maintained at 24±1°C for all the patients. Subarachnoid block was given at either L3-4 or L4-5 interspaces in sitting or lateral position using 3mL (15 mg) of hyperbaric bupivacaine 0.5% (with 8.5% dextrose) with a 25 gauge Quincke's spinal needle.

During the intraoperative period, after noting the baseline parameters, pulse rate, non-invasive blood pressure (SBP, DBP, MBP), oxygen saturation, temperature (core and surface) and level of sensory block was assessed at 5-min intervals. Sensory block was assessed every 5 min till the level of block was established, and every 15 min thereafter. The core temperature was measured by a nasopharyngeal probe and surface temperature by an axillary probe.

Shivering was graded using a scale validated by Tsai and Chu: grade 0=no shivering, 1=piloerection but no visible shivering, 2=muscular activity in only one group, 3=muscular activity in more than one muscle group but not generalized and 4=shivering involving the whole body. During surgery, the shivering scale was recorded at 5-min intervals up to 120 min of surgery. The prophylaxis was regarded as ineffective if the patients exhibited grade 3 shivering any time during the study and then i.v. pethidine 25 mg was administered as a rescue drug.

Side-effects such as hypotension, nausea, vomiting, hallucinations and sedation were also recorded. Hypotension defined as a decrease in mean blood pressure (MBP) of more than 20% from the baseline and bradycardia as heart rate less than 60 BPM. Hypotension was treated with i.v. incremental bolus dose of mephentermine 3 mg and a further intravenous infusion of Ringer lactate. Bradycardia was treated with atropine 0.01mg/kg BW. If any of the patients developed nausea and vomiting metoclopramide 10 mg was administered. Hallucination as a side-effect defined as a false sensory experience, where the patients reported that they saw, heard, smelled, tasted or felt something that was non-existent

was treated with midazolam 0.03mg/kg body wt. The attending anaesthetist also assessed the degree of sedation on a 5-point scale. 1=fully awake and oriented, 2=drowsy, 3=eyes closed but arousable to command, 4=eyes closed but arousable to mild physical stimulation and 5=eyes closed but unarousable to mild physical stimulation. Motor block of the patient was assessed using Modified bromage scale, 0 = No motor block; 1 = Can flex knee, move foot, but can't raise legs; 2 = Can move foot only; 3 = cannot move foot or knee.

Postoperative

Patients were observed for shivering in postoperative period, initially hourly for two hours then 2 hourly for next 4 hours.

Post operatively patients were also monitored for any complications like sedation, hallucinations, nausea, vomiting and hypotension

RESULTS

The mean age, gender, and the duration of surgery were comparable in all study groups and there was no statistically significant difference among the groups [Table 1].

Table-1: Comparison of patient demographics

Variables	Group P	Group K	Group T	P value
Age	38.4±8.61	36.1±10.52	36.6±8.09	0.751
Male/female	21/9	20/10	22/8	0.957
Weight	61.17±8.55	63.21±9.49	60.73±7.31	0.403
ASA I/II	25/5	22/8	23/7	0.957
Duration of surgery	89.93±17.4	91.80±19.8	94.73±15.3	0.761

While comparing the mean heart rate, there was a statistically significant difference among the groups throughout the duration of observation/surgery. The heart rate in group p and group t were comparable but the mean heart rate in group K was higher as compared to group p and group t at 5, 10, 15 & 30mins which was statistically significant with p value <0.001.Fig 1.

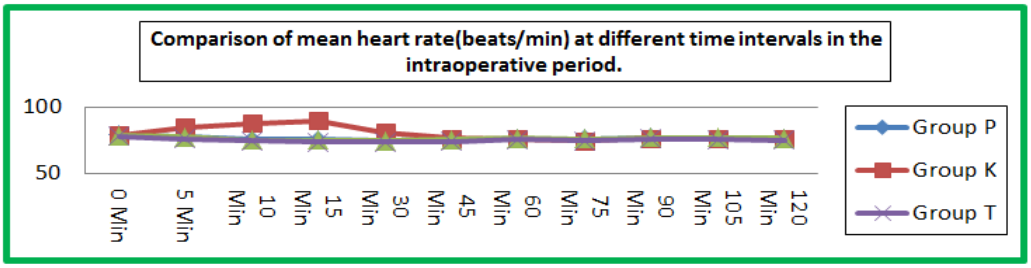

Fig-1

The three groups were comparable as regard the mean systolic blood pressures at 0 min and 5 min. This difference was, however, statistically significant at all other times. There was statistically significant difference among the groups, when they were compared on the variables of mean diastolic blood pressure and mean MAP.

There was statistically significant difference in the three groups throughout the duration of surgery, when the mean surface temperatures were compared. The surface temperatures showed progressively increasing trend in all three groups for most of the observations. The mean temperature in group K, and group T were comparable but the mean temperature in group P was lower as compared to group K, and group T at different time intervals which was statistically significant with p value <0.001.fig.2.

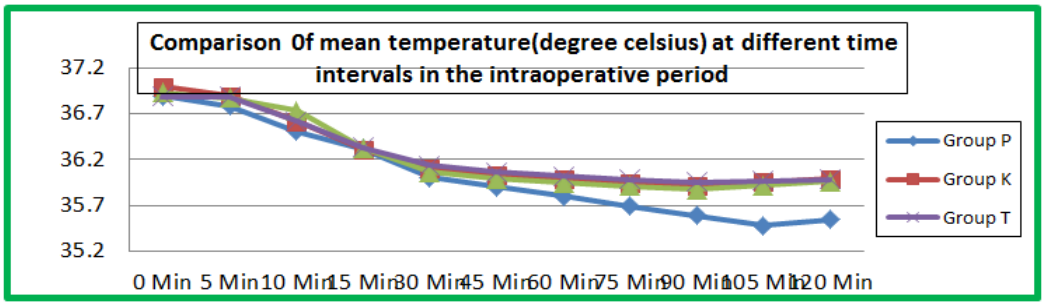

Fig-2

There was statistically significant difference among the three groups, when overall shivering grades were compared. The grades of shivering in group K, and group T were comparable but there is statistically significant difference in grades of shivering among group P and group K, and group T, with p value <0.001.fig.3.

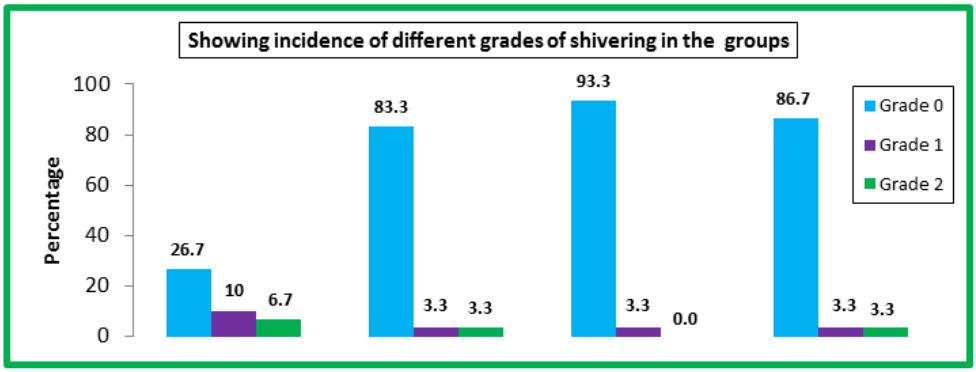

Fig-3

No hallucinations or nausea/vomiting were observed in any of the study groups.

DISCUSSION

In our study, the incidence of shivering was 56.7% (in the placebo group). Our study was compared with various studies which were done from time to time. Sagir *et al*. [13] conducted a study in 2006 evaluated the effect of prophylactic i.v ketamine (0.5mg/kg), granisetron (3mg) and placebo before giving subarachnoid block. They concluded that prophylactic use of 0.5mg/kg i.v ketamine was effective in preventing shivering developed during shivering.

Gangopadhyay *et al*. [14] in 2010 conducted a study to compare pethidine, tramadol and ketamine in prevention of shivering caused by subarachnoid block and also to compare their adverse effects. patients received Group P (pethidine 0.4mg/kg), Group T(tramadol 1.0mg/kg)and Group K (ketamine 0.5mg/kg) intravenously just before giving spinal anaesthesia, they concluded that although pethidine, tramadol and ketamine effectively prevent shivering following spinal anaesthesia ,the better haemodynamic stability and less adverse effect prove katamine as a better alternative than other two drugs.

There was a greater fall in core body temperatures in the placebo group as compared with the ketamine, and tramadol groups in our study. This trend in core temperature is similar with the trends reported by Sagir [13] and Tewari *et al*. [15] greater falls in core temperature in the placebo group as compared with the other groups may be because of the study drug effect.

In our study, the incidence of side-effects was not significantly different among the groups. Tramadol has the potential to cause nausea and vomiting, but the incidence of nausea and vomiting in the study groups was comparable with the placebo group. Similar results are reported in the literature [16, 17]. However, Gangopadhyay *et al*. [18] observed a significant number of case (20/30) of nausea and vomiting with tramadol; this high number of cases in the tramadol group could be explained by the fact that they used tramadol at 1mg/kg i.v. as compared with 0.5mg/kg i.v. in our study, the incidence of hypotension and bradycardia in the study groups was comparable with the placebo group, which was in concordance with other studies [19]. Ketamine is known to cause hallucinations, but none of the patients complained of hallucination in any of the groups. Studies done in the past support our findings [20].

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