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Original Research Article

To Compare The Efficacy of IV Ketamine, IV Tramadol, IV Dexmedetomidine for Post Spinal Shivering Management

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Abstract:

Introduction: Spinal anaesthesia is commonly used as a safe anaesthetic technique for both elective and emergency operations. Shivering is known to be a frequent complication in patients undergoing surgery under neuraxial anaesthesia with incidence of 40–70%. Shivering is described as an involuntary, spontaneous, and repetitive muscular movement, caused by vasoconstriction in upper limbs compensating the lower limb vasodilation. Hypothermia is one of the frequent causes that lower the shivering threshold. Shivering causes increase oxygen consumption, increase the risk of hypoxemia, induce lactic acidosis, and catecholamine release. We used different pharmacological drugs to control post spinal shivering.

Methodology: In this prospective observational study, 90 patients who are candidates for subarachnoid block undergoing surgeries with American Society of Anesthesiologist (ASA) I or II, between 18 to 60 years, who are scheduled for abdominal and lower limb surgeries and who developed shivering following spinal anaesthesia we will divide them into 3 groups. Group A will get low dose iv ketamine(0.25mg/kg), Group B will get iv tramadol(0.5mg/kg), Group C will get iv dexmedetomidine(5mcg/kg).

Result: Shivering was controlled in 24 (80%) patients in the ketamine group and 22 (74%) patients in the tramadol group, whereas it was controlled in 27 (90%) patients in the Dexmedetomidine group.

Conclusion: Low-dose ketamine (0.25 mg/kg) ,tramadol (0.5 mg/kg) and dexmedetomidine (0.5mcg/kg) intravenously is efficient in lessening the shivering in patients having lower abdominal surgery under subarachnoid anaesthesia. However, Dexmedetomidine is associated with higher effective rate of shivering control.

Introduction

Shivering is a physiological response characterized by involuntary, spontaneous, and repetitive muscular contractions. It serves as the body's mechanism to generate heat when it perceives a drop in core temperature, thereby helping to maintain thermal homeostasis[1]. Hypothermia, or a decrease in body temperature below the normal range, is a common trigger for shivering. When the body senses a decrease in temperature, the shivering threshold is lowered, leading to the initiation of shivering to generate heat and counteract the hypothermia.

Subarachnoid block, also known as spinal anesthesia, can indeed significantly impact the body's thermoregulation system, particularly by affecting tonic vasoconstriction. Subarachnoid block disrupts sympathetic nervous system function by blocking the transmission of nerve signals from the spinal cord. The sympathetic nervous system plays a crucial role in regulating vascular tone and orchestrating vasoconstriction responses to maintain blood pressure and redistribute blood flow. Various pharmacological agents have been utilized to prevent or mitigate post-spinal anesthesia shivering, particularly in surgical settings where patients are at risk of experiencing temperature dysregulation[2].

There are five agents -magnesium sulfate, NMDA receptor antagonists, opioids, dexmedetomidine, biogenic amines (serotonin 5 HT3 receptor antagonist), and cholinomimetics have been used for post-spinal anesthesia shivering. Each of these pharmacological agents may offer benefits in different clinical scenarios based on factors such as patient characteristics, surgical procedure, and anesthesia technique[3].

The choice of agent and dosing regimen should be individualized and guided by considerations such as efficacy, safety profile, and patient-specific factors. Additionally, non-pharmacological measures such as active warming techniques and ambient

temperature regulation may complement pharmacotherapy in managing perioperative thermoregulation and preventing shivering[4].

Tramadol inhibits the reuptake of serotonin and norepinephrine, leading to enhanced neurotransmitter activity. This modulation of neurotransmitter systems may play a role in regulating thermoregulatory pathways and reducing the shivering response.

Dexmedetomidine is a highly selective alpha-2 adrenergic agonist. By binding to alpha-2 receptors in the central nervous system, its activity on alpha-2 receptors in the hypothalamus contributes to its potential to modulate thermoregulatory pathways.

Ketamine's effects on NMDA receptors may influence central thermoregulatory pathways, leading to a decrease in the shivering threshold and attenuation of shivering in response to cold stimuli. Ketamine's modulation of neurotransmitter systems, including glutamate and dopamine, may also play a role in regulating thermoregulation[5]. The primary objective of the present study was to compare the efficacy of drugs for prevention of shivering.

Methodology

This is a prospective observational study. After Institutional Ethical Committee approval, written informed consent was received from 90 patients American Society of Anesthesiologist (ASA) I and II aged 18–60 years, who were undergoing for surgery under subarachnoid anesthesia from July 2023 to september 2023 at Gandhi medical college, Bhopal.

Patients undergoing for surgery under subarachnoid anesthesia with age between 18 to 60 years with ASA grade I and II were included

Refusal from patient and patients having allergies to study drugs were excluded from the study.

Standard monitoring was established for monitoring non-invasive blood pressure (NIBP), electrocardiograph (ECG), temperature, and peripheral arterial oxygenation (SPO2%). The temperature of the operating room was maintained at 21°C to 23°C.

Spinal anaesthesia was performed at the level of L3-L4 or L2- L3 through a midline approach using a 23gauge Quincke spinal needle, Hyperbaric 0.5% bupivacaine 15 mg (3ml) was injected intrathecally in all patients. All patients received 4 L/min of O2 by simple face mask. Tympanic membrane temperature and core temperatures (Nasopharyngeal thermometer) were observed and documented every 5 minutes until the end of the surgery. Patients were covered with drapes but not actively warmed. Intravenous fluids were not warmed in order to avoid effect of warm fluid to alter the results of the study. A total of 90 patients who underwent surgeries under subarachnoid anesthesia were enrolled in this study.

Once patients developed shivering, they were randomly allocated into 3 groups. Of these patients, 30 were allocated to the ketamine group (Group A), 30 to the Tramadol group (Group B) and 30 to the dexmedetomidine group (Group C). Group A received iv ketamine (0.25mg/kg) slowly, Group B received iv tramadol (0.5mg/kg) slowly and Group C received iv dexmedetomidine (0.5mcg/kg) slowly.

Grade of shivering	Clinical sign
0	No shivering
1	Peripheral vasoconstriction or piloerection, but no obvious shivering
2	Muscular activity in only one muscle group
3	Muscular activity in more than one muscle group, but not generalized
4	Shivering involving the whole body

Observation and Results

Table 1: demographic data

Characteristics	Group A (n=30)	Group B (n=30)	Group C (n=30)	p-value
Age (years)	35±8	37±9	34±8	0.9
Height (cm)	162±10	163±12	160±9	1.1
Duration of surgery (minutes)	58±16	60±16	56±14	0.8
Total intravenous fluid (mL)	1700±200	1600±200	1800±300	0.75
Estimated blood loss (mL)	300±50	270±40	290±50	0.85

There were no significant differences for patient's demographic data and duration of surgery among the studied groups.

Table 2: Vitals

Characteristics	Group A (n=30)	Group B (n=30)	Group C (n=30)	p-value
MAP (mmHg)	85±12	87±13	84±11	0.53
Pulse rate (bpm)	88±19	90±21	89±20	0.68
SPO2 (%)	98.2±1	98.1±1	98±1	0.47
Tympanic temperature (0C)	36.4±0.40	36.7±0.50	36.5±0.45	0.64

Table 3: Shivering

Shivering	Group A (n=30)	Group B (n=30)	Group C (n=30)	p-value
Controlled	24(80%)	22(74%)	27(90%)	0.67
Not Controlled	6(20%)	8(26%)	3(10%)	0.66

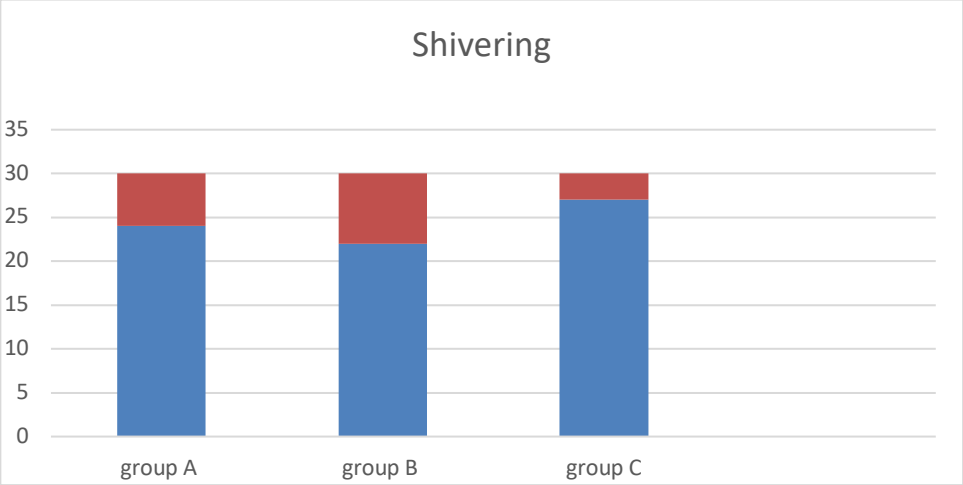

Figure 1: Shivering

Table 4: Adverse effects

Characteristics	Group A (n=30)	Group B (n=30)	Group C (n=30)	p-value
Nausea & Vomiting	4(13%)	9(30%)	3(10%)	0.12
Hypotension	5(17%)	6(20%)	12(40%)	0.35
Bradycardia	0	0	2(6%)	1.2
Sedation	2(6%)	1(3%)	10(33%)	0.04*

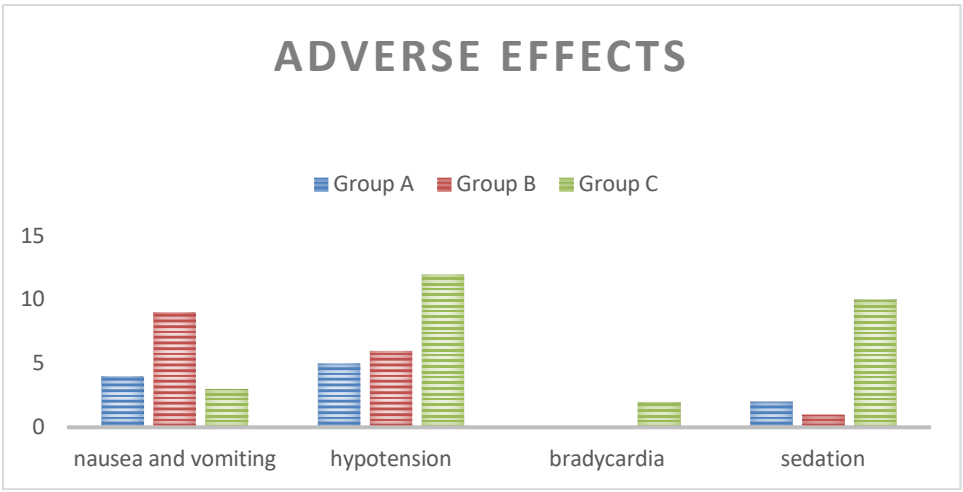

Figure 2: Adverse Effects

The study included 90 patients undergoing surgeries under subarachnoid anesthesia, with 30 patients allocated to each of the three treatment groups: ketamine (Group A), tramadol (Group B), and dexmedetomidine (Group C).

Shivering was controlled in 24 out of 30 patients (80%) in the ketamine group. In the tramadol group, shivering was controlled in 22 out of 30 patients (74%). The dexmedetomidine group showed the highest efficacy, with shivering controlled in 27 out of 30 patients (90%).

Dexmedetomidine had a higher incidence of hypotension and bradycardia compared to ketamine and tramadol. This is attributed to dexmedetomidine's inherent property of activating alpha-2 adrenoceptors in the central nervous system, leading to decreased heart rate and blood pressure.

Nausea and vomiting were more common with tramadol (30%) compared to ketamine (13%) and dexmedetomidine (10%).

Sedation achieved with dexmedetomidine was superior, with 33% of patients experiencing significant sedation compared to 6% with ketamine and 3% with tramadol.

Discussion

Study findings suggest that dexmedetomidine may be more effective in reducing shivering time compared to tramadol and ketamine, but it's associated with higher incidences of hypotension and bradycardia. Tramadol had higher recurrence rates of shivering and more incidences of nausea and vomiting compared to ketamine and dexmedetomidine.

Dexmedetomidine also provided better sedation, which is beneficial during surgeries under spinal anesthesia. Dexmedetomidine appears to be more effective in reducing the time it takes for shivering to cease compared to tramadol and ketamine. This suggests that dexmedetomidine may be a preferable option when rapid cessation of shivering is desired.

However, the use of dexmedetomidine is associated with higher incidences of hypotension and bradycardia. This indicates that while it may be effective in reducing shivering, clinicians need to be mindful of these potential side effects and take appropriate measures to manage them.

Tramadol, on the other hand, shows a higher recurrence rate of shivering compared to ketamine and dexmedetomidine. This suggests that while tramadol may initially alleviate shivering, it may not provide long-lasting relief compared to the other two drugs.

Tramadol is also associated with a higher incidence of nausea and vomiting compared to ketamine and dexmedetomidine. This highlights a potential drawback of tramadol in the context of managing shivering during surgery.

Dexmedetomidine stands out for providing better sedation compared to ketamine and tramadol. This sedative effect is beneficial for the comfort and amnesia of the patient during surgery, as well as for the ease of the surgeon and anesthetist in performing the procedure.

However, it's important to acknowledge the limitations of your study. The absence of prior studies comparing these three drugs for controlling shivering and the lack of data specific to the Indian population suggest the need for further research to confirm and expand upon our findings.

Conclusion

Administration of low-dose ketamine (0.25 mg/kg) ,tramadol (0.5 mg/kg) and dexmedetomidine (0.5mcg/kg) intravenously is efficient in lessening the shivering in patients having lower abdominal surgery under subarachnoid anesthesia. However, Dexmedetomidine is associated with higher effective rate of shivering control, shorter time to cease shivering, lesser recurrence of shivering, lower incidences of nausea and vomiting, higher incidences of hypotension, bradycardia and sedation . Dexmedetomidine demonstrated superior efficacy in controlling shivering compared to ketamine and tramadol.

However, it was associated with a higher incidence of hypotension, bradycardia, and sedation. Tramadol showed a higher incidence of nausea and vomiting compared to ketamine and dexmedetomidine. These findings suggest that while dexmedetomidine may be more effective in controlling shivering, careful consideration of its adverse effect profile, particularly cardiovascular effects and sedation, is warranted.

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