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ORIGINAL RESEARCH REGIONAL ANESTHESIA

Comparative efficacy of intravenous tramadol and traditional blanket coverage in managing postoperative shivering among post-spinal anesthesia patients

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ABSTRACT

Background & Objective: Shivering after general as well as spinal anesthesia is a common phenomenon. Unmanaged post-anesthetic shivering can worsen postoperative pain and patient's metabolism. Various techniques including inj. tramadol, body warming, and covering have been evaluated to treat this common complication. We aimed to compare the effectiveness of tramadol administration with patient coverage as therapeutic methods for managing post-anesthesia shivering.

Methodology: The study enrolled 60 patients who underwent spinal anesthesia. Patients were divided into two groups: Group A received blanket coverage as treatment for shivering, while Group B received intravenous tramadol. Shivering onset time and duration after treatment were measured. Descriptive statistics and chi-square test/independent t-test determined significance, with $P < 0.05$ considered statistically significant.

Results: The findings of this study revealed no significant difference in the onset of shivering between patients who received intravenous tramadol and those who were covered by blankets (39.83 ± 13.21 min vs 38.60 ± 13.48 min). However, the duration of shivering after treatment was significantly shorter in patients who received intravenous tramadol compared to those who received blanket, e.g., 20.30 ± 9.62 vs. 34.83 ± 12.53; $P < 0.000$).

Conclusion: In conclusion, intravenous tramadol is more effective than non-pharmacological methods (blankets) in managing shivering. Tramadol treatment resulted in a significantly shorter duration of shivering.

Keywords: Postoperative Shivering; Hypothermia; Spinal Anesthesia; Tramadol; Blanket

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1. INTRODUCTION

Postoperative shivering following anesthesia leads to an increased metabolic demand, which is directly influenced by the amount of muscle mass engaged and the cardiac status of the patient. The primary approach to prevention involves actively rewarming the patient to avoid preoperative hypothermia. Rapid postoperative skin surface rewarming is an effective method to achieve the shivering threshold temperature, thereby elevating the skin temperature and enhancing patient comfort. However, it is comparatively less effective than certain medications such as meperidine, clonidine, or tramadol, which work by lowering the threshold temperature for shivering.[1,2]

Both pain and temperature signals are conveyed through comparable fiber systems that intersect at the dorsal horn regions. The rostral ventromedial medulla plays a crucial role in regulating analgesic responses to noxious stimuli and exhibits a thermoregulatory reaction to peripheral warming and cooling. One significant function of the rostral ventromedial medulla is to modulate the quantity of pain and temperature input ascending from the spinal cord by controlling the transmission of neuronal signals at the level of the dorsal horns.[3]

Shivering can also be linked to heightened adrenergic and sympathetic hyperactivity, leading to potential organ dysfunction, including myocardial ischemia. Moreover, shivering can result in patient discomfort and raise the risk of postoperative complications, such as infection, pain, and bleeding.[4,5]

Shivering has been observed to potentially contribute to delayed wound healing and an extended hospital stay. The increased metabolic demand may be dangerous for patients with pre-existing conditions such as intrapulmonary shunts, fixed cardiac output, or limited respiratory reserve. However, due to the age-related impairment of normal thermoregulatory control, shivering is infrequent among elderly patients.[6]

Shivering is recognized as a significant and prevalent concern for patients, given its association with heightened pain levels at the surgical site, increased metabolic demands, elevated oxygen consumption, and compromised hemostasis if not addressed. We assessed the effectiveness of intravenous administration of tramadol and the use of blankets, in the prevention of shivering following anesthesia.[7]

2. METHODOLOGY

Demographic data, including gender, age, weight and any previous surgery, was recorded in case of all patients. A descriptive analytical cross-sectional method was used for this study. The study was conducted from June 4, 2023 to November 16, 2023, and involved 60 adult patients who underwent elective surgical procedures.

Preoperative temperature was recorded for every patient. All patients were administered spinal anesthesia with bupivacaine 0.5% heavy 2-3 mL using a needle size ranging from 25 to 27 G. Intravenous fluids were infused at a controlled room temperature of 24°C-26°C, while patients were provided with a single standard blanket to ensure warmth and comfort. The type and the temperature of fluids infused were noted.

Time to onset of shivering after the surgery and the total time of continued shivering were noted. Patients' temperature, before, during and after the operation was noted.

For prevention of postoperative shivering, two distinct treatment approaches were implemented. In Group A (30 patients) was treated with blankets, and Group B (30 patients) was injected inj. tramadol 1 mg/kg IV preemptively. The study sought to evaluate various parameters and their mean values, standard deviations, and p-values to determine the potential benefits of each treatment approach.

Statistical analysis

The statistical analysis was conducted using IBM SPSS version 21. The mean time of shivering was calculated for the two treatments to evaluate the differences between the two groups. An independent t-test was used to compare the means of the two groups. A $P < 0.05$ was considered statistically significant, indicating the presence of a significant difference between the treatments.

3. RESULTS

The demographic profile and type of operative procedures were consistent across all the groups as depicted in Table 1.

The results presented in Table 2 provide comparative effectiveness of two treatments for shivering: intravenous tramadol and traditional blanket coverage.

4. DISCUSSION

Regarding the treatment of shivering, intravenous tramadol proved effective in 46.7% among male patients, whereas the use of a blanket resulted control of shivering in 23.3%. It indicates that a higher percentage of male patients were treated for shivering with

Table 1: Demographic characteristics of two groups

Items		Blanket Group	Tramadol Group	P – value
Gender	Male	7 (23.3)	14 (46.7)	0.058
	Female	23 (76.7)	16 (53.3)	
Age (y)	< 30	10 (33.3)	15 (50.0)	0.683
	31-40	10 (33.3)	6 (20.0)	
	41-50	4 (13.3)	5 (16.7)	
	51-60	2 (6.7)	2 (6.7)	
	61-70	3 (10.0)	1 (3.3)	
	>70	1 (3.3)	1 (3.3)	
Weight (kg)	50-60	8 (26.7)	3 (10.0)	0.316
	61-70	14 (46.7)	14 (46.7)	
	71-80	6 (20.0)	9 (30.0)	
	81-95	2 (6.7)	4 (13.3)	
Previous surgery		11 (36.7)	8 (26.7)	0.405
Type of surgery	Cesarean section	18 (60.0)	11 (36.7)	0.090
	Hernia repair	6 (20.0)	7 (23.3)	
	Hemorrhoidectomy	4 (13.3)	2 (6.7)	
	Orthopedic surgery	2 (6.7)	8 (26.7)	
	Urinary tract operation	-	2 (6.7)	
IV Fluid type	Normal saline	30 (100.0)	24 (80.0)	0.036*
	Dextrose saline	0.0 (0.0)	2 (6.7)	
	Mix (normal saline + blood)	0.0 (0.0)	4 (13.3)	
Condition of the IV fluid during operation	Room temperature	29 (96.7)	22 (73.3)	0.011*
	Warm + Room temp	1 (3.3)	8 (26.7)	

*Data are n (%). Pearson Chi-Square Test, *: P < 0.05 considered as significant.*

intravenous tramadol compared to a covered blanket, which is consistent with previous reports.[8-10] Conversely, among female patients, 76.7% received shivering treatment with a blanket, while 53.3% received treatment with intravenous tramadol. Despite not finding a significant difference, a higher number of females were treated with the blanket.

The age groups with the highest usage of a blanket were < 30 y, with a mean age of 40.07 ± 15.22 years, while the age group in the intravenous tramadol group was < 30 y, with a mean age of 36.47 ± 14.47 y, which is consistent with prior studies,[10-13] although another study reported higher ages.[8,9] No significant age-related differences in shivering treatment were observed, regardless of whether a blanket or intravenous tramadol

was used. Moreover, the study found that the weight groups with the highest usage in both groups were 61-70 y. The mean weight in the blanket group was 67.27 ± 8.72 kg, while in the intravenous tramadol group, it was 70.53 ± 9.50 kg, which were slightly higher compared to some earlier studies,[14, 15,16,17] but similar to some other studies.[13,18]

In terms of the type of recent operation, there were no differences between the groups. However, the highest incidence of the recent operation type was observed among patients undergoing cesarean section, with 60.0% receiving a blanket, while 36.7% received tramadol treatment.

Another parameter evaluated was the type and volume of fluid or blood administered during the operation. The patients in the blanket group received 1683.33 ± 608.61 ml of normal saline, while the patients in the tramadol group received a volume of 1516.67 ± 533.10 ml, demonstrating a significant difference (P = 0.036). Additionally, blood was only administered in the tramadol group. Considering the range of total fluid or blood volume administered during the operation was higher compared to that reported in the prior studies.[17,19]

Table 2: Parameter comparison in two groups

Items	Blanket Group	Tramadol Group	P – value
Weight (kg)	67.27 ± 8.72	70.53 ± 9.50	0.17
Age (y)	40.07 ± 15.22	36.47 ± 14.47	0.35
Total fluid or blood used during surgery per patient (mL)	1683.33 ± 608.61	1566.67 ± 583.29	0.45
• Normal saline	1683.33 ± 608.61	1516.67 ± 533.10	0.264
• Dextrose saline	0.000 ± 0.000	50.00 ± 273.86	-
• Blood	0.000 ± 0.000	50.00 ± 152.56	-
Onset of the shivering (min)	38.60 ± 13.48	39.83 ± 13.21	0.722
Time period of shivering (min)	34.83 ± 12.53	20.30 ± 9.62	0.000**
Dose of bupivacaine (mL)	2.45 ± 0.20	2.50 ± 0.26	0.411
Temperature, preoperative (°C)	36.63 ± 0.22	36.73 ± 0.29	0.149
Temperature, intraoperative (°C)	36.17 ± 0.30	36.19 ± 0.39	0.794
Temperature postoperative (°C)	35.88 ± 0.35	35.84 ± 0.38	0.728

*Data presented as mean ± SD; Independent Samples Test. **: P < 0.05 -considered significant*

A higher proportion of patients (9.7%) experienced shivering with fluid at room temperature in the blanket group, while the rate was 73.3% with intravenous tramadol treatment as previously reported.[21] This significant difference (p = 0.011) suggests that intravenous tramadol may be more effective in reducing shivering under specific fluid conditions.

The study also examined shivering onset and duration. Shivering onset was similar between the blanket group vs the tramadol group (38.60 vs 39.83 minutes), which was higher compared to a prior study,[20,22] but without a statistically significant difference. However, the time to stop shivering was significantly less in the tramadol group compared to the blanket group (P < 0.001). The result was higher than what has been reported in earlier studies.[14,20,21]

The mean bupivacaine volume used was comparable in the two groups with no significant difference.

Regarding the temperature range, before, during, and after the operation, a previous study reported slightly lower temperature ranges than those recorded in this study.[17] The mean temperature range before the operation was almost consistent with previous reports.[12,14,16,17,23-25] There was no statistically significant difference in the temperature range before, during or after the operation.

5. LIMITATIONS

This study has a limitation in terms of a small sample size. Furthermore, the focus of the study on a specific patient population and surgical setting may restrict the applicability of the results to other contexts.

6. CONCLUSION

The intravenous tramadol group exhibited a significantly shorter duration of shivering compared to the blanket group. These findings suggest that intravenous tramadol may be a more effective treatment option to control shivering after surgical procedures compared to merely using a blanket.

7. Data availability

The numerical data generated during this research is available with the authors.

9. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

10. Ethical consideration

All procedures in this study were employed according to the guidelines established by the Department of Anesthesia, Faculty of Medical Technology, Surman and the Declaration of Helsinki. Ethical committee approval was obtained for sample collection in accordance with these guidelines.

11. Authors contribution

All authors made substantial contributions to the acquisition of data, analysis of data, and interpretation of the results. All authors have reviewed and approve the final version of the manuscript submitted for publication.

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