

Original Article

Factors Influence Shivering Phenomenon Post Spinal Anesthesia

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ABSTRACT:

Background: Shivering is a prevalent complication encountered by patients following anesthesia. The incidence of shivering after anesthesia can be influenced by factors such as age and the temperature of the operating room. The aim of this study was to compare the occurrence of shivering during surgical procedures among patients who experienced no shivering and those who did. Methodology: data from 60 patients who underwent spinal surgery under anesthesia. We divided them into two groups: 30 without shivering (Group A) and 30 treated with tramadol for shivering (Group B). Results: incidence of shivering among younger patients (<30 years of age). Furthermore, shivering was observed during blood transfusion, and high incidence with patient had undergone a cesarean section (36.7%), in those who received cold liquid during the operating (73.3%), and in those who had not undergone previous surgery (73.3%). Moreover, there were significant correlations between shivering and factors such as age, temperature range during and after the operation (°C), and the condition of the administered liquid during the procedure. Conclusion: the occurrence of post anesthesia shivering in relation to various demographic and procedural factors. The range of age and temperature during and after the operation showed a significant association with the incidence of shivering.

Keywords: Shivering, Postoperative, Complications, Tramadol, Spinal, Anesthesia.

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INTRODUCTION:

Some people who have surgery may experience shivering and hypothermia, which can have various physical causes. For example, they may be exposed to a cold environment in the operating room, affected by some anesthetic drugs, or stressed by the surgery. These conditions can increase the demand for oxygen in the body and raise the risk of heart problems. They can also impair blood clotting and wound healing, Furthermore, shivering can interfere with non-invasive blood pressure measurement using devices like Oscillo metric monitors [1].

Post-operative shivering, which affects a significant proportion of patients ranging from 40% to 70%, emphasizes the clinical significance of shivering in this patient population [2]. Furthermore, shivering can cause a serious complication by increasing oxygen demand and CO₂ production [3]. Some patients think that the cold sensations they feel during surgery are more unbearable and harmful to their body than the surgical pain itself. The cold can be very uncomfortable and cause physical strain, and the reason that

tremors happen is not clear, but they are mainly caused by low body temperature during surgery. shivering or hypothermia happen because the spinal or epidural anesthesia affects the body's ability to regulate its temperature. Tremors are a way for the body to try to warm up or a result of muscle movements that can be steady or irregular. They can occur at different speeds. Shivering can happen after surgery even when the body is not cold. This can be because of other factors that affect the muscles, such as spinal reflexes, nervous system activity, pain, hormones, infection, and blood acidity [4].

The occurrence of shivering and thermal discomfort can significantly impact the overall quality of patient recovery following surgery. Not only does shivering pose challenges to the patient's comfort, but it can also exacerbate postoperative pain by placing additional strain on the surgical incision site. To address this issue, various strategies have been developed to control shivering during anesthesia. Non-pharmacological approaches aimed at maintaining normal body temperature through the use of specialized equipment have been shown to mitigate shivering. However, these methods are often impractical and expensive, limiting their widespread implementation. In contrast, pharmacological interventions using drugs with anti-shivering properties offer a simpler, cost-effective, and easily implementable alternative [5].

Several drugs have been identified for their anti-shivering effects, including pethidine, tramadol, clonidine, doxa pram, nefopam, among others. These pharmacological agents offer viable options for managing shivering after surgery, providing simplicity in administration, affordability, and ease of use [6].

Shivering can have several detrimental effects on postoperative patients. Firstly, it can lead to increased oxygen consumption, placing additional strain on the respiratory system and potentially making breathing more

challenging. Moreover, shivering has been associated with a heightened risk of complications following surgery. While shivering commonly occurs when the body is excessively cold, it is noteworthy that patients with a normal body temperature may also experience shivering during or after surgical procedures. Despite its clinical significance, the precise underlying causes of shivering remain poorly understood, necessitating further research to elucidate its mechanisms [7].

It is worth noting that shivering after surgery is a prevalent issue, affecting a substantial proportion of patients who undergo general anesthesia. Studies have reported shivering incidence rates ranging from 20% to 70% among this patient population. Such a high prevalence underscores the importance of addressing shivering as an integral aspect of perioperative care [5].

Women who undergo cesarean deliveries often experience postoperative pain, which is a frequent and distressing phenomenon. It can lead to adverse outcomes such as prolonged recovery and can induce side effects such as breathing difficulties, nausea, and shivering [8]. A variety of pharmacological interventions, including pethidine, tramadol, propofol, nefopam, alfentanil, and fentanyl, have been recommended for managing postoperative shivering. Among these, opioids such as alfentanil and fentanyl have shown promise in suppressing shivering by binding to central nervous system opioid receptors. Utilizing these anti-shivering drugs can effectively address postoperative shivering and improve patient comfort during recovery [9].

Tramadol, known for its analgesic properties through the inhibition of norepinephrine and serotonin reuptake, has also shown a significant anti-shivering effect in a small clinical trial. The study reported that tramadol raises the shivering threshold, leading to a reduction in shivering incidence and intensity. The study also explored other interventions such as warming, cooling, and covering [10,11].

The purpose of this study was to evaluate the various and influential factors that contribute to the occurrence of shivering subsequent to spinal anesthesia.

METHOD:

Subjects of study and classification:

This randomized, prospective trial conducted from February 1 to May 22, 2023, involved 60 adult patients undergoing elective surgical procedures in the lower abdomen, including cholecystectomy, hernia repair, hemorrhoidectomy, orthopedic surgery, urinary tract interventions, and cesarean sections, with the patients randomly assigned to three groups: Group A (without shivering, n=30) and Group B (shivering, n=30) treated with Tramadol.

Sample collection:

The anesthetic drug "Marcaine" was used at a dose of (2-3 cc) for patients who underwent spinal anesthesia. The size of the needle used for spinal anesthesia was (25–27G). Intravenous fluids maintained at room temperature (24°C–26°C) and warm and cold fluid were infused and all patients were covered with a single standard blanket. After 12-60 minutes of the operation, shivering occurred in patients who underwent treatment for shivering with Tramadol, shivering occurred 14-60 minutes after the procedure. Where a dose of 1 mg/Kg of tramadol was used.

Data Analysis:

Statistical analysis was performed using IBM SPSS version 21 software. A statistical procedure was implemented to compare the

means of two independent groups (Non-shivering and shivering receiving Tramadol) to determine if there was a significant difference between them. Means of factors such as age, weight, dose of anesthesia, operation temperature ranges, volume of fluid or blood during surgery, and other variables were compared between these groups by an independent t-test. Differences are expressed as mean ± standard deviation (SD). P-value < 0.05 was considered statistically significant.

RESULTS:

We analyzed data from 60 patients who underwent spinal surgery under anesthesia. Of 60 patients, 30 developed tremors and received tramadol, while 30 did not. We found that shivering varied by age and weight. We observed the highest frequency of shivering in patients under 30 (50%), followed by 31-40 (20%), 41-50 (13.3%), and 51-60 (6.7%). Age may influence tremor during surgery.

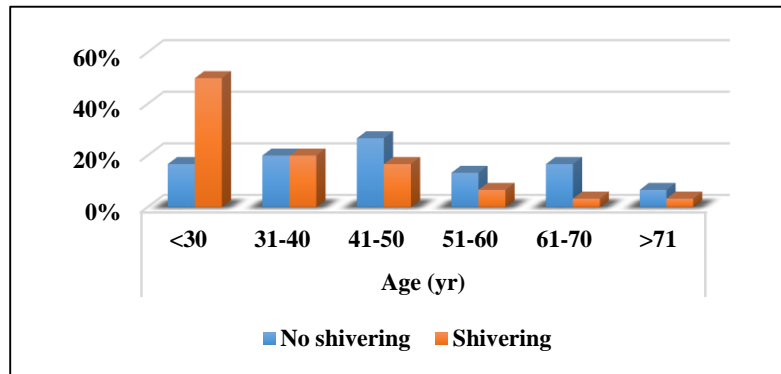
The occurrence of shivering varied across weight categories. Among patients without shivering, the highest frequency was observed in the weight range of 61-70 kg (33.3%), followed by 71-80 kg (33.3%). Among patients with shivering, the highest frequency was observed in the weight range of 61-70 kg (46.7%), while the lowest occurrence was in those weighing 50-60 kg (10.0%). The presented table provides a distribution that offers valuable insights into the potential impact of weight on shivering occurrences during surgical procedures.

Table 1. The age and weight characteristics of the (60) participants.

		Group A (30)		Group B (30)		Total
		Frequency	Percent (%)	Frequency	Percent (%)	
Age (yr)	≤30	5	16.7	15	50.0	20
	31-40	6	20.0	6	20.0	12
	41-50	8	26.7	5	16.7	13
	51-60	4	13.3	2	6.7	6
	61-70	5	16.7	1	3.3	6
	≥71	2	6.7	1	3.3	3

Weight (Kg)	50-60	4	13.3	3	10.0	7
	61-70	10	33.3	14	46.7	24
	71-80	10	33.3	9	30.0	19
	81-95	6	20.0	4	13.3	10

Fig 1. Distribution of patients in the study samples



This study found a significant association between age and shivering occurrence ($P = 0.006^{**}$), with patients without shivering having a higher mean age (47.63 years) compared to those with shivering (36.47 years). However, no significant difference was observed for weight and shivering occurrence

($P = 0.248$), with patients without shivering having a mean weight of 73.43 kg and those with shivering having a mean weight of 70.53 kg. (see table 2).

This study examined the association between shivering occurrence and various variables, including anesthesia dose, preoperative temperature ranges, and fluid or blood volume

during surgery. However, no significant associations were found between shivering occurrence and these variables.

Significant differences were found in the incidence of shivering and temperature ranges during and after the operation. Patients without shivering had higher mean temperatures during the operation (36.54°C) and after the operation (36.68°C) compared to those with shivering (36.19°C and 35.84°C , respectively) ($P < 0.001^{**}$). However, no significant differences were found for the temperature range before the operation ($p = 0.055$).

Table 2. Basic characteristics of two groups (Non-Shivering & Shivering).

	Shivering Occurrence	Min	Max	Mean	± SD	P- value
Age (yr)	Group A	18.00	80.00	47.63	15.61	0.006*
	Group B	22.00	72.00	36.47	14.47	
Weight (Kg)	Group A	55.00	95.00	73.43	9.76	0.248
	Group B	50.00	95.00	70.53	9.50	
Dose of anesthesia (ml)	Group A	2.00	3.00	2.42	0.32	0.278
	Group B	2.00	3.00	2.50	0.26	
a- Range of temperature before the operation ($^{\circ}\text{C}$)	Group A	36.30	37.70	36.88	0.33	0.055
	Group B	36.00	37.70	36.73	0.29	
b- Range of temperature during the operation ($^{\circ}\text{C}$)	Group A	36.30	36.90	36.54	0.18	0.000**
	Group B	35.40	36.80	36.19	0.39	
c- Range of temperature after the operation ($^{\circ}\text{C}$)	Group A	36.20	37.00	36.68	0.22	0.000**
	Group B	35.30	36.70	35.84	0.38	

Normal saline	Group A	0.00	2500.00	1183.33	688.37	0.154
	Group B	0.00	2500.00	1433.33	653.02	
Dextrose	Group A	0.00	1000.00	100.00	305.13	0.838
	Group B	0.00	1500.00	83.33	323.86	
Blood	Group A	0.00	0.00	0.00	0.00	0.078
	Group B	0.00	500.00	50.00	152.56	

Data are mean ± SD, Independent Samples Test. *: P-value < 0.05 -significant **: P-value < 0.001 - highly significant

This study found a higher percentage of females in both the shivering group and the non-shivering group (53.3% and 66.7%, respectively). Patients who had undergone previous surgery had a higher percentage in the non-shivering group compared to the shivering group (50% and 26.7%, respectively). Additionally, the most common recent operation type in both groups was "caesarean section" (30% in the shivering group and 36.7% in the non-shivering group). In the non-shivering group, the next common conditions were "Hemorrhoid" and "Herniation" (26.7%). In the shivering group, the next common

condition was "Orthopedic" (26.7%).

The study found that normal saline was the most common type of intravenous (IV) liquid administered during the operation for both the non-shivering group and the shivering group (90.0% and 83.3%, respectively). The shivering group also received blood infusions (10%), whereas the non-shivering group did not receive blood.

However, there was a significant correlation between shivering incidents and the temperature of the IV liquid administered during the operation (p < 0.001). All patients in the non-shivering group received warm liquid (50.0%), while the shivering group was more frequently given cold liquid (73.3%).

Table 3. Basic characteristics of two groups (Shivering & no Shivering).

		Group A		Group B		X ²	P- value
		Frequency	Percent (%)	Frequency	Percent (%)		
Gender	Male	10	33.3	14	46.7	1.111	0.292
	Female	20	66.7	16	53.3		
Previous surgery	No	15	50.0	22	73.3	3.455	0.063
	Yes	15	50.0	8	26.7		
Type of recent operation	Cesarean Section	9	30.0	11	36.7	8.055	0.900
	Herniation	8	26.7	7	23.3		
	Hemorrhoid	9	30.0	2	6.7		
	Orthopedic	4	13.3	8	26.7		
	Urinary tract operation	00	00	2	6.7		
Type of IV Liquid giving during operating	Normal saline	27	90.0	25	83.3	3.277	0.194
	Dextrose saline	3	10.0	2	6.7		
	Mix (Normal saline + Blood)	00	0.0	3	10.0		
Condition of the given liquid during operating	Warm	15	50.0	00	00	39.130	0.000*
	Cold	00	00	22	73.3		
	Mix (warm+cold)	15	50.0	8	26.7		

Data are N (%). Pearson Chi-Square Test, *: p-value < 0.05 significant,

DISCUSSION:

Intriguingly, the present study sheds light on the factors influencing the mechanism underlying shivering induced by spinal anesthesia. Notably, the mechanism involves vasodilation, which plays a pivotal role in enabling rapid heat dissipation and triggering a redistribution of body heat from the central core to the peripheral tissue. Consequently, this intricate process leads to the manifestation of hypothermia accompanied by shivering [12,13].

This study aimed to examine the factors that influence the occurrence of shivering, which are involuntary muscle contractions, among patients undergoing surgical operations. We compared the frequency of tremors among different groups of patients based on their gender and age. We used statistical tests to determine whether there were any significant differences in the tremor rates between the groups. Our results showed that the gender of the patients did not have a significant effect on the tremor rates, as there were no notable differences between males and females in terms of the number of tremors they experienced during the operations. This implies that gender is not a major factor that causes tremors in surgical patients. However, we found that the age of the patients had a significant impact on the shivering rates, as there was a clear difference between the age groups in terms of the frequency of tremors they exhibited during the operations. The statistical test revealed that the difference was significant at the 0.01 level (P value = 0.006). We observed that the younger age groups had higher tremor rates than the older age groups. Specifically, the age group of less than 30 years old had the highest tremor rate, followed by the age group of 31 to 40 years old, which had a higher tremor rate than the other age groups. This suggests that younger patients are more prone to shivering during surgical operations, possibly due to their lower body temperature or higher anxiety levels. Our findings are

consistent with previous studies that reported similar results [14,15, 16, 17].

The incidence of shivering has been found to exhibit a substantial distinction in relation to age. Several scientific reasons can explain this observation. age-related changes in thermoregulatory control mechanisms may contribute to the disparity in shivering incidence. Older individuals often experience a decline in thermoregulatory sensitivity and efficiency, making them less responsive to changes in environmental temperature [18]. Consequently, they may exhibit attenuated shivering responses even in situations where shivering would be expected in younger individuals.

We divided the patients into different weight groups and compared the frequency of shivering among them. Our results showed that the weight of the patients had a significant effect on the shivering rates, as there were notable differences between the weight groups in terms of the number of shivering episodes they experienced during the operations. The statistical test revealed that the weight group of 61 to 70 kilograms had the highest shivering rate among all the weight groups. This implies that there are some underlying biological mechanisms that cause this variation in shivering frequency among different weight ranges, such as the differences in the rate of energy consumption and the regulation of body temperature across different weight levels. Our findings are in agreement with previous studies that reported similar results [14,19].

Our results showed that the dose of anesthesia, the temperature range during the operation, and the volume of fluid or blood administered during the surgery did not have any significant associations with the incidence of shivering, as these factors did not affect the number of shivering episodes the patients experienced during the operations. However, we found that the previous surgery status of the patients had

a significant association with the incidence of shivering, as there was a clear trend between the previous surgery status and the frequency of shivering among the patients. The statistical test revealed that the patients who had not undergone any previous surgery had a higher frequency of shivering occurrence than the patients who had undergone previous surgery. This suggests that previous surgical experiences may influence the occurrence of shivering during subsequent procedures, possibly due to changes in the body's physiological response to the surgical stress. We divided the patients into different groups based on the type of operation they received, such as cesarean section, appendectomy, or hernia repair. and Our results showed that the type of operation did not have a significant effect on the shivering rates, as there were no notable differences between the different groups of patients in terms of the number of shivering episodes they experienced during the operations. The cesarean section group had the highest shivering rate among all the groups, but the difference was not statistically significant. This implies that the type of operation may not be a major factor that influences the occurrence of shivering in surgical patients, Our findings are in line with previous studies that reported similar results [20].

We divided the patients into two groups based on the type of intravenous fluid they received, either blood or normal saline. We compared the frequency of shivering between the two groups of patients. Our results showed that the intravenous fluid type did not have a significant effect on the shivering rates, as there were no notable differences between the two groups of patients in terms of the number of shivering episodes they experienced during the operations. All the patients who received blood showed shivering, but the difference was not statistically significant. This implies that the intravenous fluid type may not be a major factor that influences the occurrence of

shivering in surgical patients. Our findings are consistent with previous studies that reported similar results. [14, 21]

This research aimed to investigate the effect of the fluid temperature on the occurrence of shivering, We measured the temperature of the fluid that was administered to the patients during the surgery and compared the frequency of shivering between the patients who received cold fluid and the patients who received warm fluid. Our results showed that the fluid temperature had a significant effect on the shivering rates, as there was a strong positive correlation between the fluid temperature and the frequency of shivering among the patients. The patients who received cold fluid experienced more shivering than the patients who received warm fluid, indicating that the fluid temperature might have a role in triggering shivering during surgical operations. Our findings were consistent with previous studies that reported similar results. [19, 22, 23, 24, 25] However, we disagreed with this other study that had a different opinion.[26]

CONCLUSION:

This study provides insights into the factors influencing shivering after anesthesia, including age, weight, temperature ranges, and IV liquids. Shivering occurrences were higher in younger patients (31–40 years) and those with a weight of 61–70 kg. Age and temperature ranges during and after the operation were significantly associated with shivering occurrences. However, no significant associations were found with other variables, such as gender, previous surgery, type of recent operation, type of IV liquid, and volume of fluid or blood.

RECOMMENDATION:

Based on the study findings, healthcare professionals should consider the impact of age, temperature range, and administered liquid temperature on shivering after anesthesia. Close monitoring and targeted

interventions are recommended for younger patients, and measures to maintain the warmth of administered liquids may help reduce shivering. Further research is needed to investigate additional factors and interventions for shivering prevention and management.

CONFLICT OF INTEREST:

The present study declares the absence of any conflicts of interest among the parties involved

in the research. This declaration signifies that there are no financial or personal relationships that could potentially introduce bias to the study's findings or compromise the objectivity of the researchers.

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