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RESEARCH ARTICLE

STUDY OF TRAMADOL AND DEXMEDETOMIDINE HYDROCHLORIDE FOR THE TREATMENT OF POST-SPINAL ANESTHESIA SHIVERING

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BACKGROUND: Vasoconstriction and hypothermia come before shivering. The involuntary muscular action known as shivering raises basal metabolic heat generation by about 600%. Cooling the preoptic area of the hypothalamus can cause shivering. Warming the skin can help treat shivering during regional anesthesia because it increases the amount of core hypothermia that can be tolerated by increasing the cutaneous thermal input to the central thermoregulatory system. Cooling the preoptic area of the hypothalamus causes shivering. The medial forebrain bundle receives efferent impulses that are responsible for shivering. Traditionally, it was believed that the posterior hypothalamus was the source of a central descending shivering route. The prevalence of morbid cardiac events in patients with coronary artery disease or those at high risk for developing the disease is doubled in cases of mild perioperative hypothermia.

AIM: The aim of this study was to compare and evaluate the effectiveness of the two drugs, dexmedetomidine and tramadol for control of post-spinal anesthesia shivering.

MATERIAL AND METHOD: This study was conducted in the department of Anesthesia using a double blind, randomized design. All participants gave their informed written agreement regarding their participation in the study and the use of their data for the current research project. Out of the 200 patients in this trial, 100 experienced shivering. The hospital planned to provide spinal anesthesia on these 100 patients, who ranged in age from 19 to 68 and belonged to ASA PS I, II, and III. The patients were randomized in two groups of 50 patients each to receive either dexmedetomidine 0.5µg/kg or tramadol 0.5mg/kg as an intravenous infusion via syringe pump. At predetermined intervals, the degree of shivering, when it started, when it stopped, whether it happened again, and any negative effects were noted.

RESULTS: Compared to tramadol, dexmedetomidine was found to considerably reduce the amount of time needed for shivering to stop. With tramadol, shivering is much more likely to return. Significantly more vomiting and nausea were seen in the tramadol group. Despite the fact that both medications work, dexmedetomidine causes shivering to stop sooner than tramadol does. Furthermore, there are very little side effects with dexmedetomidine, but tramadol causes noticeable nausea and vomiting. 28 patients from orthopedic surgery, 43 from general surgery, 115 from uro-surgery, and 14 from gynecological surgery were among the 200 patients who were first enrolled for the study.

CONCLUSION: Tramadol (0.5 mg/kg) and dexmedetomidine (0.5µg/kg) both works well to treat post-spinal anesthetic shivering, although dexmedetomidine took less time to completely stop the shivering than tramadol. Furthermore, less side effects including nausea and vomiting are brought on by dexmedetomidine. Compared to tramadol, the recurrence of shivering was likewise significantly lower with dexmedetomidine. More studies with different dosages of dexmedetomidine are required to solidify its position as a very effective anti-shivering medication.

KEYWORDS: Shivering, Dexmedetomidine, Tramadol, Spinal Anesthesia, Vasoconstriction and Induced hypothermia

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INTRODUCTION:

An involuntary, rhythmic muscle activity that increases the production of heat through metabolism is called shivering. The body's core temperature fluctuates according to the circadian cycle, however it typically stays between 36.5 - 37.0 °C. Though non-thermoregulatory shivering can also happen, shivering is a normal thermoregulatory reaction to cold. When body temperature falls below 35°C (95°F), it is referred to as hypothermia. This condition can be brought on by external factors, primary metabolic disorders, or therapeutic interventions. Induced hypothermia is the result of secondary hypothermia. Shivering is an attempt by the body to increase metabolic heat production in response to a drop in core temperature.[1]

Because of sympathetic block, spinal and epidural anesthesia cause vasodilatation. Below the point of blocking, it also results in the loss of thermo-regulatory vasoconstriction. As a result, heat is lost and the core temperature drops. Shivering is caused by a decrease in core body temperature, which is a result of the prolonged impairment of thermo-regulatory autonomic function under anesthesia, the cool operating room environment, and rapid fluid infusion. Shivering is a common, unsettling adverse effect of neuraxial anesthesia. Shivering has also been linked to medication reactions, blood transfusion reactions, and pre-existing high-grade fever. The most frequent reason for shivering, however, is perioperative hypothermia.[2] Shivering was found to occur 8.18% of the time in patients undergoing subarachnoid blocks for lower limb and lower abdomen surgery by Kolawole and Bolaji.[1]

Shivering patients use more oxygen, which puts them at risk for hypoxemia and may delay their release from the post-anesthesia care unit. As a result, oxygen therapy is recommended. During central neuraxial anesthesia, shivering movements can disrupt the monitoring of blood pressure, ECG, and pulse oximetry. In addition to being a painful experience that may lower patient satisfaction, its negative repercussions call for quick intervention to prevent them from happening. Using extra blankets and drapes is one non-pharmacological way to treat shivering. These are one of the main management strategies for the centers in Ilorin and Benin and have been demonstrated to lessen the intensity of shivering. Interventional therapy of shivering has involved the use of numerous medications. Shivering occurs in 40–60% of patients under regional anesthesia, according to De Witte J et al.; nevertheless, it is more common under general anesthesia.[3] several pharmacological drugs have been tested and compared in several trials, including Pethidine, Clonidine, Magnesium Sulphate, Ketamine, Nefopam, Amytryptyline, Urapidil, Dolasetron, and Doxapram. These medications can cause bradycardia, hypotension, respiratory depression, and other adverse effects. Tramadol has been shown in numerous tests to be effective in treating shivering. Furthermore, there are very little side effects with dexmedetomidine, but tramadol causes noticeable nausea and vomiting.[4,5]

Despite being a mild opioid, tramadol is widely accessible. This analgesic is a synthetic opioid. It acts via two different methods. inhibition of norepinephrine and serotonin reuptake as well as binding to the ε type opioid receptor. Its analgesic efficacy is roughly a tenth of morphine's. Tramadol has no effect on heart rate or blood pressure when used in therapeutic quantities, although it can cause analgesia, nausea, vomiting, dizziness, and other side effects. Dexmedetomidine is a selective α_2 adrenergic agonist and has 1600 times greater selectivity for the α_2 adrenoceptor compared with the α1 receptor. It produces sedation, anxiolysis, hypnosis, analgesia, and sympathy-lysis, and has anti-shivering properties.[6] Therefore, the purpose of this study is to investigate how tramadol and dexmedetomidine affect shivering following spinal anesthesia.

MATERIAL AND METHODS

This study was conducted in the department of Anesthesia using a double blind, randomized design. All participants gave their informed written agreement regarding their participation in the study and the use of their data for the current research project. Out of the 200 patients in this trial, 100 experienced shivering. The hospital planned to provide spinal anesthesia on these 100 patients, who ranged in age from 19 to 68 and belonged to ASA PS I, II, and III. The patients were randomly assigned to one of two groups consisting of fifty patients each, to receive an intravenous infusion via syringe pump of either tramadol 0.5 mg/kg or dexmedetomidine 0.5μg/kg. At predetermined intervals, the degree of

shivering, when it started, when it stopped, whether it happened again, and any negative effects were noted.

Inclusion Criteria

- ASA grade I or II or III
- Age 18 to 65 years
- Undergoing Spinal anesthesia
- Lower abdominal surgeries and lower limb general surgeries.

Exclusion Criteria

- known hypersensitivity or allergy to study drugs.
- Cardio-pulmonary, renal, or hepatic impairment.
- known history of substance or alcohol abuse
- blood transfusion during surgery hypo- or hyperthyroidism
- convulsions or psychiatric disorder
- patient refusal
- pregnancy and lactation

Blinding

A drug was prepared by an anesthetist who is not a part of the study as per the randomization list. The prepared drug was labeled with the allocated serial number and the nature of the given drug was concealed from the observer and the patient

Methodology

Patients between the ages of 19 and 68 who were posted for lower limb general surgeries and lower abdominal surgeries under spinal anesthesia and who were willing to participate in our study were randomly assigned to either of the two groups, Inj. Dexmedetomidine or Inj. Tramadol.

- Inj. Dexmedetomidine is available in ampoules of 0.5 ml (50 µg) or 1ml (100 µg). A 50 ml syringe is loaded with 2 ml of the drug and diluted with normal saline, to sum up to 50 ml (4 µg/ml). The syringe is then connected to the IV extension line after freeing it of air, the other end is connected to a three-way cannula.
- Inj. Tramadol is available in an ampoule of 1ml (50mg) or 2ml (100mg). A 50 ml syringe is loaded with 4 ml of the drug and diluted with normal saline, to sum up to 50 ml (4 mg/ml). The syringe is then connected to the IV extension line after freeing it of air, the other end is connected to a three-way cannula.

Procedure

Along with his medical record file, the patient was moved from the surgical ward to the preoperative ward. We measured the patient's height, weight, and overall condition. BMI was computed in this manner. A thermometer was used to assess the preoperative axillary temperature. Before the patient was sent to the operating room, an intravenous (IV) access was established in the pre-operative ward using an 18-G cannula and preloaded with fluid. A constant temperature of 23–25°C was maintained in the operation room. The syringe pump was equipped with the prepared study medicine and adjusted based on the patient's body weight. A single layer of surgical drapes enveloped each patient, revealing only the operative site. IV fluids were utilized at room temperature during the procedure.

After administering a subarachnoid block, if the patient began to shiver, the prepared medication infusion was started right away, and the time and severity of the shivering were monitored. In addition to IV fluid treatment at 1.5ml/kg/hr, a blinded observer administered the study medication in 50ml of NS over the course of five minutes using a three-way adaptor. Monitoring of blood pressure, heart rate, O_2 saturation, and ECG changes was noted at the interval of 3 mins for 30 mins followed by 15 mins intervals intraoperatively. Additional measures, such as the axillary temperature, were measured both when the shivering started and stopped. In addition to the patient mentioned above, this one was followed and asked about any discomfort or clinical symptoms on a regular basis. After five minutes, the medication infusion was discontinued, and Crossley's grading system was used to record the degree of shivering.

STATISTICAL ANALYSIS

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM, Chicago, IL). Data are presented as mean ±SD or numbers as appropriate. Patient characteristics (age, weight, height, parity, and gestational age), were analyzed using the independent two-sample t-test.

RESULT: -

Table 1: - Incidence of Shivering

Gender	Shivering(n)	Incidence (%)
Male	80	44.1
Female	20	43.5
Total	100	44.05

Table 1 showing the incidence of shivering in the hospital among different gender. We included 200 patients in our study, 150 were males and 50 were females. Out of 150 males 80 developed shivering and out of 50 females 20 developed shivering. Hence the incidence of shivering in our setup is 44.05%, it is 44.1% among males and 43.5% among females.

Table 2:- Incidence of Shivering In Different Surgical Procedures

	Orthopedic Surgery	General Surgery	Uro-surgery	Gynecological Surgery	Total Cases
No of pts developed shivering (**Group A) [n]**	7	16	22	4	49
No of pts developed shivering **(Group B)[n]**	10	14	23	4	51
Total pts developed Shivering (**n**)	17	30	45	8	100
Total Patients (**n**)	28	43	115	14	200
Incidence of shivering (**%**)	56.25	60.42	37	30	44.05

Table 2 shows, incidence of shivering among different surgical procedures. Out of 200 patients who initially recruited in the study, 28 were from orthopedic surgery, 43 from general surgery, 115 from uro-surgery and 14 from gynecological surgery. Among those patients 17(7 Group A and 10 Group B) from orthopedics, 30 (16 in Group, 14 in Group B) from general surgery, 45 (22 Group A, 23 Group B) from uro-surgery and 8 (4 each from group A & B) from gynecological surgical patients developed shivering. The incidence of shivering found to be 56.25%, 60.42%, 37% and 30% respectively.

Table 3: Demographic Data

	GROUP A (Mean+ SD)	**GROUP B (Mean+ SD)**
AGE (years)	45.10±12.60	43.24±12.40
HEIGHT (m)	1.60±0.05	1.62±0.07
WEIGHT (kg)	58.68±8.31	59.65±10.13
BMI (kg/m^2)	20.63±2.95	21.03±3.24

Table 3 shows comparison of age, height, weight and BMI of the patient among the 2 groups. The mean age of the patients in Group A is 45.10±12.60 yrs. and in Group B is 43.24±12.40yrs. The mean height of the patients in Group A and Group B are 1.60±0.05 & 1.62±0.07 meters respectively. The mean weight of patients in Group A was 58.68±8.31kgs and in Group B 59.65±10.13kgs. Mean BMI in Group A is 20.63±2.95 kg/m2 and in Group B is 21.03±3.24 kg/m^2. All of the above data are comparable in both groups.

DISCUSSION

The amount of time between the start of the shivering and the Grade 0 shivering is the duration of time it took for the shivering to stop. In our investigation, it took Group A 3.50±1.02 minutes and Group B 5.02±1.40 minutes to stop shivering. When shivering is controlled with dexmedetomidine instead of tramadol, it happens much more quickly. More time and medication were needed to manage shivering at higher grades.

Liu ZX et al.2015[7] conducted a meta-analysis with 0.5µg/kg of dexmedetomidine and compared it with a placebo group. When compared to the placebo group, they found that dexmedetomidine had a greater ability to lessen shivering. The results showed that dexmedetomidine was more effective than a placebo, but not more effective than other anti-shivering medications. **Bansal et al.2011**[8] In our study recurrence of shivering was defined as progress ION of shivering to Grade 1 or more, 15 minutes after the initial shivering which was controlled with the study drug. it is found that there is significant higher incidence of recurrence of shivering with tramadol than dexmedetomidine (11 vs 2), but the mean time of recurrence time with both the drugs are comparable.

Niranjan Kumar Verma et al.2013[9] in his study used Tramadol 2mg/kg (maximum 100 mg) given IV slowly over two minutes in post spinal anti-shivering agent in comparison to Clonidine 0.5 mcg/kg diluted to 10 ml and Dexmedetomidine 0.5 mcg/kg diluted to 10 ml. According to their research, recurrence was zero when using Tramadol 2 mg/kg in contrast to Clonidine and Dexmedetomidine. **Joshi S S et al.2008**[10], in their study was given either 0.03 mg/kg of inj. butorphanol 1%, 0.06 mg/kg of inj. ondansetron or 1.0 mg/kg of inj. tramadol 1% IV. They came to the conclusion that there was no statistically significant variation in recurrence between the groups. This is in contrast to the findings made by **Maheswari et al.2018**[11], found a lower risk of recurrence with tramadol compared to butorphanol **Tanveer Singh Kundra et al.2017**[12] in their study compared dexmedetomidine with tramadol for their efficacy on post spinal anesthesia shivering. In their investigation, bradycardia was present in one patient in the dexmedetomidine group but not in the tramadol group. The occurrence, though, lacked statistical significance. Delxmedetomidine causes a considerable reduction in heart rate (HR) just after shivering stops, although it has no effect on the incidence of bradycardia (HR<60/min). The reduction in heart rate that occurs right after stopping shivering when taking dexmedetomidine is caused by the drug's natural ability to lower heart rate through postsynaptic activation of α2 adrenoceptors in the central nervous system.

The patient found the tympanic and nasopharyngeal temperatures uncomfortable and intolerable during the spinal anesthetic procedure. Even though it was possible to measure the rectal temperature, it was not done so since it was difficult during lower abdominal surgery. Thus, we took an axillary temperature reading. Even though the amount of fluid infused was recorded, the patient's characteristics and the length of the surgery could have affected the temperature and rate of IV fluid, which could have changed the outcome. Moreover, side effects including bradycardia and hypotension might have been brought on by the study medication or by sympathetic blocking during spinal anesthesia. Another drawback is that the two research medications do not have a fixed equipotent dose, which was overlooked while the trial was being designed.

CONCLUSION:

Tramadol (0.5 mg/kg) and dexmedetomidine (0.5µg/kg) both work well to treat post-spinal anesthetic shivering, although dexmedetomidine took less time to completely stop the shivering than tramadol. Furthermore, less side effects including nausea and vomiting are brought on by dexmedetomidine. Compared to tramadol, the recurrence of shivering was likewise significantly lower with dexmedetomidine. More studies with different dosages of dexmedetomidine are required to

solidify its position as a very effective anti-shivering medication.

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