

## Effectiveness Dose of Ketamine for Control of Shivering During Spinal Anesthesia in Surgeries

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### Abstract

**Introduction:** Considering that spinal anesthesia is a safe method of anesthesia for surgery, but about 40 to 60 percent of patients are experiencing tremor. For patients undergoing new methods of spinal anesthesia, shivering is very undesirable and from the physiological aspect is very stressful, mild tremor increases the oxygen consumption like a light physical activity and judder increases the metabolic rate and oxygen consumption up to 600%. This case causes a reduction in the amount of arterial oxygen, metabolic acidosis. Ketamine is a safe drug, in recent study determines of Effectiveness dose of ketamine for control of shivering during spinal anesthesia in surgeries.

**Methods and materials:** This is a randomized double-blind study, that the statistical population was patients that were candidates for general surgery, that were referred to hospitals of University of Medical Sciences for treatment. The patient's undergone surgery with spinal anesthesia with number 1, 2 and 3 anesthetic Class based on anesthesiologist detection. From 355 patients that were randomly selected, 175 people were selected for experimenting group with ketamine injection with drug pump of 0.2 mg/kg and 180 people were selected for the placebo control group (distilled water) of the Pasteur pharmaceutical company with a drug pump of 0.2 mg/ kg.

**Discussion:** Ketamine infusion at in spinal anesthesia can reduce the amount of shivering during the surgery and can be an effective choice in the field of surgery.

**Conclusion:** The shivering in the experimenting group was lower than the control group and was statistically significant. Tremor intensity in the experimental group was lower than the control group in all three measures (1, 2 and 3), which was also significant for comparing the linear regression, relative risk(RR) was 18 in two groups according to the normal distribution of the data, in the age group between 30 to 45 years the minimum range of tremor was observed and in the age group that were younger than 30 years range of tremor was observed. Most people were in the age group of 40-30 years (60%) with orthopedic surgery.

**Keyword:** Ketamine, Shivering, Spinal Anesthesia, Surgery

### Introduction

Considering that spinal anesthesia is a safe method of anesthesia for surgery, but about 40 to 60 percent of patients are experiencing shivering. for patients undergoing new methods of spinal anesthesia, shivering is very undesirable and from the physiological aspect is very stressful, mild tremor increases the oxygen consumption like a light physical activity and judder increases the metabolic rate and oxygen consumption up to be 600%. This case causes a reduction in the amount of arterial oxygen, metabolic acidosis, increased intraocular

pressure and increased intracranial pressure, and ECG monitoring, pulse rate, blood pressure and pulseoximetry are interference track in this situation. A variety of methods exist to control shivering during spinal anesthesia: Such as non-pharmacological methods that are devices and equipments that are used to maintain body temperature significantly, but these equipment may be expensive and not practical in all situations. In the pharmacological methods, several drugs have been studied for the prevention or treatment of tremor, including pethidine, flax serine, sufentanil, alfentanil, tramadol, Nefopam, physostigmine, Doksapram, clonidine and Nalbofen. These days the attempt is to use the drugs that are simple,

cost-effective and readily available. Although the mechanism of all drugs are not fully understood but the impact on body temperature regulation center, opiate receptors, antagonists control of N-methyl-D-aspartate receptor in the regulation of body temperature reduces the tremor and shivering. Ketamine is a safe drug, which is cheap and available that can inhibit shivering by controlling the competitive antagonist of -methyl-D-aspartate receptor. In recent studies the effects of ketamine alone or with other medications to reduce tremor during and after surgery with different doses (from 0.5 To 7mg/kg) has been approved but the doses, have side effects such as hallucinations, that appropriate dosage in reducing tremor needs to be obtained by appropriate research. Other studies compared the effect of ketamine, pethidine and tramadol with comfort, tremor and temperature inside the esophagus that showed the impact of three drugs to prevent tremor during spinal anesthesia, but better hemodynamic stability and having less side effects of ketamine, is superior to the two other drugs. In a study in 2013 in South Africa on 90 patients with 60-18 years that spinal anesthesia for lower limb surgery was performed, it was found that the effect of low-dose midazolam (0.2 mg/kg) with ketamine in prevention of tremor is equal to the effect of higher doses of midazolam by 0.25 mg/kg with ketamine. The effect of ketamine in cesarean section with spinal anesthesia revealed that 0.25 mg/kg ketamine, as much as 0.5 mg/kg ketamine is effective in preventing tremor. In Iran a study in the field of contrasting the effect of different doses of ketamine and pethidine in reducing the tremor after cesarean surgery was performed, the results showed that: Although ketamine significantly controls the tremor but pethidine is still a better choice for this complication. Therefore, in this study the effect of intravenous ketamine at a dose of 0.2 mg/kg to prevent tremor in patients undergoing spinal anesthesia were evaluated [1-13].

#### Methods and materials

This is a randomized double-blind study, that the statistical population was patients that were candidates for general surgery, urology and orthopedic with the age group between 20 and 60 years that were referred to hospitals of University of Medical Sciences for treatment. Patients with emergency surgery, receiving blood and blood products, surgery less than half an hour and more than two hours, further period of anesthesia during surgery that requires medical intervention (drug) and those that have a history of chronic disease and drug consumption were excluded. After obtaining permission from the ethics committee of the University and necessary information, the consent of the patients have completed and the patients undergone surgery with spinal anesthesia with number 1,2 and 3 anesthetic Class based on anesthesiologist detection. From 355 patients that were randomly selected, 175 people were selected for experimenting group with ketamine injection related to Rotex of Germany with drug pump of 0.2 mg/kg and 180 people were selected for the placebo control group (distilled water) of the Pasteur pharmaceutical company with a drug pump of 0.2 mg/kg.

Spinal anesthesia was performed with bupivacaine 90% from the Aburayhan Company and lidocain 10% from drug Distribution Company, in number 3 and 4 lumbar vertebrae space of the patient who is in sitting position, with the help of spinal needle in proper operation position and stable homo dynamic situation. During the surgery, we tried to maintain the temperature of the operating room at about 22° C. Then the patient was observed with the help of anesthesiologist during the surgery using a visual scale of vibrating or not and the degree of tremor (from zero to three), and required data

were recorded in the check list. The tremor degree was determined as followed: - grade number zero was without shivering –grade number one was classy, mild tremor of the face and neck – grade number two was visible tremor in more than one muscle group – grade number three was the whole body muscle activity [14]. Then the data were given to the SPSS20 software and was analyzed with independent t-test and regression.

#### Discussion and Conclusion

In this study, 175 patients were selected for experimenting group and 180 patients were selected for the placebo control group (from 355 patients), for comparing the two groups according to the normal distribution of the data, linear regression, t-test and post hoc test were performed. The average age in the control group was (13 ± 36) years and the average age in the intervention group was (11 ± 38) years and a significant difference with the age was observed (p = 0.001), in the age group between 30 to 45 years the minimum range of tremor was observed and in the age group that were younger than 30 years and older than 50 years, the maximum range of tremor was observed. Most people were in the age group of 40-30 years (60%) with orthopedic surgery.

The shivering severity of the patient's body was recorded in the anesthesia class (class one, two, three) during the surgery by an anesthesiologist, according to the physiological conditions and (Table 1). In this study, all hemodynamic parameters were similar for both groups, except ketamine infusion; anesthesia and the surgical procedures were performed in the operating room under the same conditions. The chill in the experimenting group was lower than the control group and was statistically significant (p = 0.05). Shivering intensity in the experimental group was lower than the control group in all three measures (1, 2 and 3), which was also significant (p = 0.03). According to (Table 2), from 179 patients in the control group 63.6% of patients had no chills and 37.4% experienced the chill. From 176 patients in the experimenting group, 76.6% had no chills and 24.3% experienced the chill. With Ketamine injection of 0.2 mg/kg, reducing from grade number 3 to zero was tangible (P = 0.038).

The results of this study matched with the study of Mr. Dahl and colleagues in Turkey and confirm the effects of ketamine's doses in reducing the chill during spinal surgery. Also in this study, according to the (Table 3), significant correlation between patient's ages and reduction in chills with ketamine injection in both groups, were observed. In the experimental group at an early age, the intensity of shivering increased but then it was considerably decreased and again at 50 years of age, an increase in shivering was observed. Which has been confirmed in other clinical trials? According to the table (3), in this study, using regression analysis, significant correlation was observed between shivering in both groups and surgery (P = 0.01), the highest chills was in general surgery and orthopedic surgery and the lowest chills was in urology surgery. The tremor was also higher in women than men, and this co-relation was statistically significant (P = 0.006). This relationship shows that women are more prone to chills and necessary dose of ketamine is more effective in this group.

Controlling and reducing the chill in the spinal and local anesthesia is one of the most challenging issues in anesthesia, and drugs including ketamine have the major impact in this area. Because of low price and availability of ketamine, this drug is distinguished in this context. But the determination of a single dose of ketamine according to hallucinogenic effects of this drug after the patient's

recovery causes an extensive research on the drug's dose. In this study, it was shown that the effect of low-dose ketamine (0.2mg/kg) compared to the standard that was set for other studies (0.5- 0.7. mg/kg) was effective in reducing the intensity of chills during the surgery with spinal anesthesia and controlling factors such as gender and type of surgery and anesthesia class can be very effective [15]. Also in this study, a comparison between the types of anesthetic drugs and ketamine dose with shivering was not performed but according to previous studies [16]. This factor can be very effective that by choosing a suitable auxiliary drug in spinal anesthesia (e.g., low dose of petedin or diazepam) that does not have a synergic or antagonistic interfere with the injection of ketamine, shivering during the surgery can be controlled [17-19]. Hemodynamic status such as temperature, oxygen consumption, cell metabolism and electrolytic stability can be maintained with controlling the chill. The effective dose of ketamine with the amount of 2.0 mg per kg of body weight to control or reduce the severity of shivering in this study had the same preventing effect in reducing the chill in patients who had undergone the spinal anesthesia with the study that was conducted by Coase and colleagues, with the ketamine dose of 0.25 mg per kg of body weight up to 0.5 mg per kilogram of body. This study and other studies in addition to demonstrating the efficacy of ketamine in reducing the shivering, which confirms the results of our study, emphasized on achieving a single and effective dose [20]. The relationship between age and the dose of ketamine in both groups with decreasing the chill and its severity was observed that the amount of shivering in the age groups under 20 and more than 60 years was more than the age groups between 20 and 60 years. In other studies such as Miller and colleagues it was found out that two factors have played a decisive role in the incidence of tremor: 1 - Young people 2 – reduction in central body temperature. Also it is believed that with the increasing in the age of patients, the threshold of shivering, which in normal condition is at a temperature of 36 ° C, decreases one ° C and reaches to 35 ° C. In other words, shivering

is higher in the old and adolescents age group.

Ketamine was effective for both the upper and lower age limit that corresponds with the results of the study. Considering the prevalence of shivering among adolescents and old people, other methods of analgesia or anesthesia should be used for this age group or the necessary conditions (operating room temperature regulation function and intravenous fluids and blood, and the use of cover heating) for tremor controlling during spinal anesthesia for the patient - before anesthesia –should be provided. Other notable results from this study was the association of gender with shivering (P = 0.002), which is in same direction with available resources. In both groups, as well as control group, shivering in women was more than men. Reduction and control of shivering during and after surgery with spinal anesthesia should be determined with controlling the effective factors such as the type of anesthesia drug, age, gender and type of surgery in the study. Ketamine infusion at a dose of 0.2mg/kg in spinal anesthesia can reduce the amount of shivering during the surgery and can be an effective choice in the field of general surgery for candidates over 60 years of age or in women who are candidate for surgery.

**Table1: Shivering category in patients**

Clinical signs and symptoms of shivering	Shivering degree
Without shivering	0
Low grade shivering of face and neck	1
Visible shivering in more than one muscle	2
Intense muscular activity in whole body	3

**Table 2: The degree of shivering in both control group and experimenting group**

p- value	Total	3 degree of tremor	2 degree of tremor	1 degree of tremor	0 degree of tremor	Tremor	
						Number of patients	Group
05.0	176	0	11	30	135	Number of patients	Experimenting group
	100	0	1/6	17	7.76	Percentage of patients	
	179	7	18	40	114	Number of patients	Control group
	100	4	10	3.22	6.63	Percentage of patients	
	355	7	29	70	249	number	Total
	100	9.1	1.8	7.19	70	percent	

**Table 3: The association of demographic variables with the degree of shivering in studied group**

The significant limit	With shivering(from 1-3 degree)		Without shivering		Group	Shivering	
	Percentage	Number	Percentage	Number		Group/avariable	
0020.	13	23	44.3	78	Male	Gender	Experimenting group
	18.2	32	24.4	43	Female		
0.01	14.7	26	27.8	49	general	Type of surgery	
	10.2	18	31.8	56	orthopedic		
	3.4	6	11.9	21	urology		
0.04	3.4	6	7.3	13	≥20	age	
	13.6	24	28.4	50	20-40		
	7.4	13	27.8	49	40-60		
	2.2	4	9.6	17	≤60		
0.002	14.5	26	25.6	46	male	gender	
	25.6	46	34	61	female		
0.01	21.2	38	25.6	46	general	Type of surgery	
	14.5	26	25	45	orthopedic		
	5	9	8.4	15	urology		
0.04	6.7	12	6	11	≥20	age	
	21.2	38	33.5	60	20-40		
	10	18	18.4	33	40-60		
	1.6	3	2.2	4	≤60		

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### References

- De white, Sessler DI (2002) Preoperative Shivering: physiology and pharmacology. *Anesthesiology* 96: 467-484
- Bhatnagar S, Saxena A (2001) Tramadol for post-operative Shivering. *Anesthesia intensive care* 29: 149 -154
- Katyal Sunil, Tewari Anurag (2002) Shivering: Anesthesia considerations. *J Anesthesia Clinical pharmacology*. 2002; 18: 363-376.
- Mathews S, Almulla, Varghese Pk, Radiumk, MumtazS (2002) Post Anesthetic shivering a new look at Tramadol. *Anesthesia* 57: 39
- Sagir O, GulhasN, Topark H, YucelA, Begeg Z, Erosy O (2007) Control of Shivering during Regional Anesthesia : Prophylactic Ketamine and Granisetron. *Acta Anesthesiol Scand* 51: 44-49
- Karis Bin Misiran, Faizal Zuhri Aziz (2013) Effectiveness of low- dose midazolam plus ketamine in the prevention of shivering during spinal anesthesia for emergency lower limb surgery. *SAJAA* 3: 164-170
- Dal D, Kose A, Honca M, Akinci B, Basgul E, et al. (2005) Efficacy of prophylactic ketamine in preventing postoperative shivering. *Br J Anaesth* 95: 189-192.
- Cattaneo CG, Frank SM, Hesel TW, El-Rahmany HK, Kim LJ, et al. (2000) The accuracy and precision of body temperature monitoring methods during regional and general anesthesia. *Anesth Analg* 90: 938-45.
- Tsai YC, Chu KS (2001) A comparison of tramadol, amitriptyline, and meperidine for post epidural anesthetic shivering in parturient. *Anesth Analg* 93: 1288-1292.
- Sagir O, Gulhas N, Toprak H, Yucel A, Begeg Z, et al. (2007) Control of shivering during regional anesthesia: prophylactic ketamine and granisetron. *Acta Anaesthesiol Scand* 51: 44-49.
- Srikanta Gangopadhyay, Krishna Gupta, Smita Acharjee, Sushil Kumar Nayak, Satrajit Dawn, et al. (2010) Ketamine, Tramadol and Pethidine in prophylaxis of Shivering during Spinal Anesthesia. *J Anaesth Chin Pharmacol* 26: 59-63.
- Kose EA, Honca M, Dal D, Akinci SB (2013) Aypar Prophylactic ketamine to prevent shivering in parturients undergoing cesarean delivery during spinal anesthesia . *J Clin Anesth* 25: 275-280.
- Pazuki SH, Noruzi A, shademan A (2011) Compare of effective dose of ketamine and pethedin for decrease shivering post operation. *Scientific journal of Arak university* .YEAR12.N47 9-6.
- Alireza Mahoori, Mohammad Amin Valizade Hasanloei, Ebrahim Hassani, Farnaz Sadighi (2013) The effect of intravenous low dose ketamine for prevention of shivering after inguinal herniorrhaphy. *URMIA MED J* 24: 784.
- Sellden E, Lindahl S (1999) Amino acid-induced thermogenesis reduces hypothermia during anesthesia and shortens hospital stay. *Anesth analg* 89: 1551-1556.
- Kelsaka E, Sibel B, Deniz K, Binnur S (2006) Comparison of ondansetron and meperidine for prevention of shivering in patients undergoing spinal anesthesia. *Reg Anesth Pain Med* 31: 40-45.
- De Witte J, Sessler DI (2002) Perioperative shivering: physiology and pharmacology. *Anesthesiology* 96: 467-484

18. Tsai YC, Chu KS (2001) A comparison of tramadol, amitriptyline, and meperidine for postepidural anesthetic shivering in parturients. *Anesth Analg* 93: 1288-1292.
19. EA Kose, M Honca, D Dal, S.B. Akinic (2013) Prophylactic Ketamine to prevent shivering in parturients undergoing Cesarean delivery during spinal anesthesia. *Journal of clinical Anesthesia* 25: 275-280.
20. Bahman Hasannasab, Nadia Banihasham, Afshin Khoshbakht, Ziba ShirKhani (2013) Efficacy of prophylactic low dose ketamine in preventing shivering after general anesthesia. *J Mazandran Univ Med Sci* 23: 89-93.
21. Kose EA, Dal D, Akincis B, Saricaoglu F, Ayparu (2008) The Efficacy of Ketamine for Treatment of Post-operative shivering. *Anesthesia and Analgesia* 106: 120-122.
22. *World Anesthesia Issue* 15 (2005) Article 3. Comment: William English.
23. Joyce Generali, Dennis J.Cada (2007) Granisetron: Post Anesthetic Shivering. *Hospital Pharmacy* 42: 424-429.
24. Ahmed A, Aslam M (2013) Prevention of shivering during lower segment cesarean section; Comparison of prophylactic use of ketamine, and ketamine plus midazolam during spinal anesthesia. *Professional Med J* 20: 409-415.
25. Yoshitero Yano, Massato Nakasuji, Soon-Hak Suh, Masataka Nomura, Motoko Shimizu, et al. (2013) Kansai Denryoku Hospital, Osaka, Japan. Intraoperative small dose of ketamine prevents Remifentanyl-induced post anesthesia shivering. American society of anesthesiologist's annual meeting A1 South Area G. *Anesthesiology*.
26. Beena Yousuf, Khalid Samad, Hameed Ullah, Muhammad Q Hoda (2013) Efficacy of tramadol in preventing postoperative shivering using thiopentone or Propofol as induction agent : A randomized controlled trial. *Journal of anesthesiology clinical pharmacology* 29: 4.
27. Mirza Koeshardiandi, Nancy Margarita R (2011) The effectiveness of ketamine dose 0.25 mg/kg body weight intravenous as a therapy of shivering during spinal anesthesia in section cae saria surgery. *Media Journal of Emergency* 1: 12.

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