ORIGINAL ARTICLE

Effect of Low Dose Intravenous Dexmedetomidine for the Prevention of Shivering Following LSCS Under Spinal Anaesthesia: A Randomised Control Trial

Megha Gandotra, Anju Jamwal, Anurati Raina, Sakshi Gupta

Abstract

Background: Shivering is one of the most common side effects after cesarean section under neuraxial anesthesia due to inhibition of thermoregulatory control. However, it is often not treated. **Aims & Objectives** : This study aimed to evaluate the effect of low dose Dexmedetomidine on shivering in patients undergoing C-sections after spinal anesthesia. **Materials & Methods :** This randomized placebo controlled clinical study included 128 patients of ASA group II undergoing lower segment cesarean section under spinal anesthesia. They were randomly divided two groups as Group D received dexmedetomidine 20µg in 1ml normal saline intravenously and Group P received 1 ml of normal saline intravenously to all parturients after the clamping of umbilical cord. All patients were evaluated during and after surgery for hemodynamic changes, incidence of shivering, sedation score and any other side effects. **Results :** The incidence of shivering in group P (56.7%) was significantly higher than in group D (10%). The mean sedation score and hemodynamic changes were not significantly different between the two groups ($P < 0.05$). No significant adverse effects were noted. **Conclusion :** The administration of prophylactic intravenous low dose dexmedetomidine effectively reduces the incidence of perioperative shivering in patients undergoing lower segment cesarean section under spinal anesthesia without causing any remarkable side effects.

Keywords

Dexmedetomidine, Shivering, Cesarean Section, Spinal Anaesthesia

Introduction

Spinal anesthesia is a desired method for patients undergoing lower segment cesarean section (LSCS). It impairs the thermoregulatory system by inhibiting tonic vasoconstriction and redistribution of core heat to peripheral tissues (below the block level) which predispose to shivering.[1,2] In intrathecal anesthesia, the body temperature regulation mechanism is inhibited, which leads to perioperative hypothermia and shivering as a temperature-regulating response to hypothermia.[3] The prevalence of shivering in LSCS patients under Spinal anaesthesia is 55%.[4] Shivering is an involuntary, repetitive activity of skeletal muscles. It is believed to increase oxygen consumption and metabolic rate which increases the risk of hypoxemia, lactic acidosis and catecholamine release.[5,6] So, in order to prevent these post operative and intra-operative complications of shivering and for better patient comfort, we have to avoid shivering in the first place. There are various pharmacological and non - pharmacological methods that have been used to prevent and treat shivering. The non-pharmacological methods include warming the body surface by forced air warmers, blankets and the infusion of warm fluids. The pharmacological methods include drugs like Dexmedetomidine, pethidine, tramadol, ketamine and midazolam.[7] Dexmedetomidine is a highly selective alpha2-agonist with a selectivity ratio for the alpha 2:1 receptor of 1600:1, as compared with a ratio of 220:1 for clonidine.[8] Dexmedetomidine reduces shivering by inhibiting neuronal conductance, central thermoregulatory control and reducing shivering thresholds.[9] It helps reduce anxiety, promotes analgesia but its effect on post-spinal shivering have not been evaluated much. Hence, this study was undertaken to evaluate the effect of dexmedetomidine on perioperative shivering during spinal

PG Deptt of Anesthesia, Govt Medical College, Jammu, J&K, India

Correspondence to: Dr Anurati Raina, Deptt of anesthesia, Govt Medical College, Jammu, J&K, India

Manuscript Received: 28.12.2022; **Revision Accepted**: 04.03.2023

Published Online First: 10 Oct 2023

Open Access at: https://journal.jkscience.org

Cite this article as: Gandotra M, Jamwal A, Raina A, Gupta S. Effect of Low Dose Intravenous Dexmedetomidine for the Prevention of Shivering Following LSCS Under Spinal Anaesthesia: A Randomised Control Trial. JK Science 2023;25(4): 228-31.

anesthesia.

Materials & Methods

The present study was a randomized control trial conducted after obtaining approval from the hospital ethical committee. Written informed consent was obtained from 128 parturients of ASA class II undergoing LSCS under spinal anaesthesia.

Exclusion criteria: Patient refusal, allergy to study drugs, patients with weight >100 kgs, any absolute contraindication for spinal anaesthesia such as raised intracranial pressure, severe hypovolemia, bleeding diathesis and local infection.

Group allocation : Patients fulfilling the inclusion criteria were randomly assigned into two study groups comprising of 64 patients each and received following study drugs intravenously:

GROUP D: 20µg dexmedetomidine in 1ml of normal saline over 5 mins immediately after delivery of the baby.

GROUP P: 1ml of normal saline over 5 mins immediately after delivery of the baby.

Pre-anaesthetic check up was done one day prior to surgery and included a detailed history, general physical and systemic examination of all patients. On the morning of surgery, intravenous line was secured & ringer lactate infusion started @10ml/kg, 30 minutes before the induction of anaesthesia. All patients were covered with one layer of surgical drapes over the chest, thighs, and calves during the operation and then one cotton blanket over the entire body postoperatively. No other warming device was used. Lumbar puncture was performed using a midline approach at L3-L4 level using 25-G Quincke's needle in the sitting position. Once free flow of cerebrospinal fluid was obtained, 10 mg of 0.5% heavy bupivacaine was injected into the subarachnoid space.

Shivering was graded on a scale similar to that validated by Tsai and Chu: grade 0?=?no shivering, grade 1?=?piloerection or peripheral vasoconstriction but no visible shivering, grade 2?=?muscular activity in only one muscle group, grade 3?=?muscular activity in more than one muscle group but not generalized and grade 4?=?shivering involving the whole body. Sedation score was evaluated using Ramsey sedation score : 1-awake and alert, 2-sleepy, 3-sleepy but arousable to verbal commands, 4-sleepy but arousable to physical stimulation, 5- unconscious.

During intra operative period hemodynamic parameters like HR, SBP, DBP, MAP, SPO2 were recorded. Duration and severity of shivering, changes in body temperature and sedation score were recorded before and after spinal anesthesia, during umbilical cord clamping, and then every 5 min until 45 min after drug administration. The end of spinal anesthesia was when patients could move their legs. In the case of hypotension of more than 20% of baseline or blood pressure less than 90 mmHg, 6mg mephentermine was injected intravenously. Furthermore, a decrease in heart rate (HR < 60 beats/min) was treated with 0.5 mg intravenous atropine. Additional analyses evaluated the incidence of adverse effects including bradycardia, hypotension and nausea, vomiting.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). A chi-square test was used to evaluate the proportion of patients with decreased shivering after bolus administration in each group. A $P < 0.05$ considered statistically significant.

Results

There was no significant difference in demographic characteristics (*Table 1*) between the two study groups ($p>0.05$). Intergroup comparison of mean systolic BP and heart rate between the two groups was comparable (*Fig. 1, 2*) and statistically non-significant ($P > 0.05$). The mean incidence of shivering calculated in group D was 56.7 % whereas in group P was 10%. The mean (± SD) shivering score in the dexmedetomidine group was significantly lower by repeated measure analysis than among controls (*Table 2*) at 30mins [placebo 2.31±1.83 vs. dexmedetomidine 0.53±0.94 ($p<0.001$)], 60mins [placebo 1.74±1.78 vs. dexmedetomidine 0.94±1.39 ($p<0.005$)] and 90 mins [placebo 1.29±1.65 vs. dexmedetomidine 0.47±1.23 ($p<0.002$)]. No significant adverse effects were observed (*Table 3*).

Discussion

Perioperative shivering is a very distressing experience for the patient. It causes physiological stress, interferes with the monitoring of vital signs, and adversely affects patient comfort and satisfaction.[4] Vigorous shivering can increase the metabolic heat production up to 400% above the basal body levels thereby adversely affecting the outcome in cardiac patients. The exact mechanism of shivering during neuraxial anaesthesia has not been fully understood but the possible explanations include cessation of central thermoregulation, internal redistribution of body heat, and heat loss to the environment.[10] Temperature of the operating room and intravenous solutions is another reason for heat loss intraoperatively.[11] In our study, we maintained the temperature of the operating room at 27°C, and all fluids and drugs were warmed before infusing. Many pharmacological therapies like mepridine, ketamine, tramadol and clonidine have been used to prevent shivering in the past but the search for a safe & efficacious therapy that prevents shivering without causing respiratory depression, hemodynamic instability or excessive sedation still continues.[12,13]

The description of dexmedetomidine safety in obstetric patients in many recent studies has increased the interest for its use as an alternative treatment option for shivering in post-spinal parturients.[14,15] Dexmedetomidine by acting onalpha-2 adrenergic receptors reduces the

Table 1: Demographic characteristics of study patients in two groups

Parameter	Group A Mean ±SD	Group B Mean ±SD	P-value
Age (Years)	25.5 ±2.367	25.1 ±2.896	0.387
Weight (Kg)	67.54 ±1.681	67.10 ±1.515	0.172
Height	157.12 ±2.438	156.58 ±1.401	0.178

Fig 1: Graph representing comparison of Mean arterial pressure (MAP) in two groups

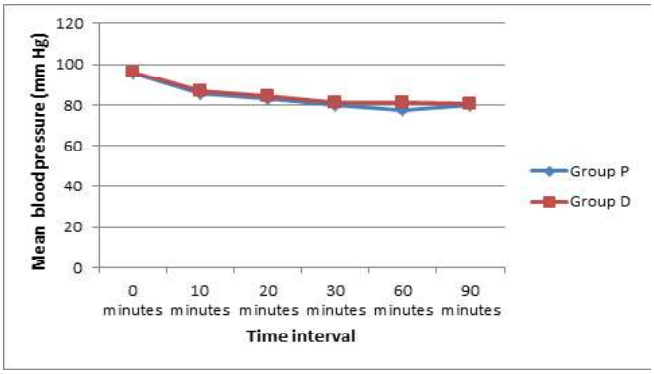

Fig 2: Graph representing comparison of intraoperative Heart rate (HR) in two groups

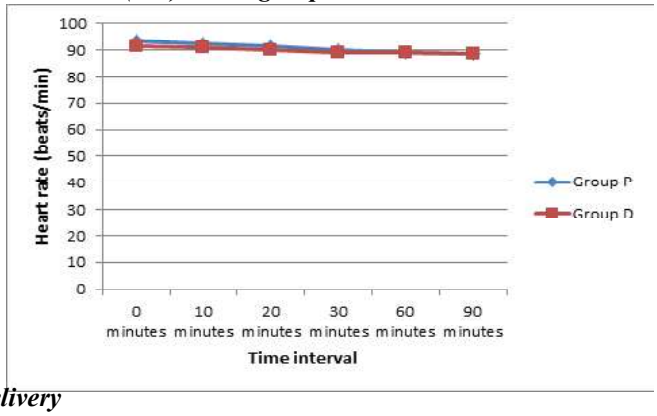

Table 2: Comparison based on shivering in two groups after delivery

Time Interval	Group D Mean	Group D SD	Group P Mean	Group P SD	P-value
30 Minutes	0.53	0.94	2.31	1.83	<0.001*
60 Minutes	0.94	1.39	1.74	1.78	0.005*
90 Minutes	0.47	1.23	1.29	1.65	0.002*

Table 3: Comparison of side effects in two groups

Side effects	Group D No.	Group D %age	Group P No.	Group P %age	P-value
Nausea	3	4.7	1	1.6	0.612
Vomiting	2	3.1	0	0.0	0.496
Bradycardia	1	1.6	0	0.0	0.293

shivering threshold by inhibiting the sympathetic tone and attenuation of neuroendocrine and hemodynamic responses.[16] Also, the doses needed to suppress shivering are too small to cause any side effects like hypotension, bradycardia or sedation. Abdel-Ghaffar *et al* studied three intravenous doses of dexmedetomidine for the treatment of post spinal shivering (0.5 μg·kg?1, 0.3 μg·kg?1, and 0.2 μg·kg?1) and found that 0.3 μg·kg?1 was the most effective.[17] On the basis of this study, a fixed dose of 20 μg was selected.

The mean incidence of shivering following neuraxial anesthesia in obstetrical populations has been reported at approximately 55% with the range of 40-64%, which is consistent with the incidence of 56.7% reported in placebo group of our study.[4] Bicer *et al* reported the incidence of shivering as 15% with dexmedetomidine and 55% with placebo following general anesthesia which is similar to our study with the incidences being 10% and 56.7%, respectively.[18] Coskuner et al used higher iv dose of 1μg/kg in their study and observed decrease incidence of shivering with significant increase in the requirement of atropine in their first group as higher dose of dexmedetomidine caused bradycardia.[19]

In our study we have seen that the mean time of shivering after giving dexmedetomidine was shorter in patients who received inj dexmedetomidine as compared to the patients who didn't receive it. The results of our study are in agreement with the study done by Sween

LK *et al* who concluded that prophylactic administration of intravenous dexmedetomidine 10µg after the delivery of the baby significantly reduces intra operative and perioperative shivering as (placebo 1.8 ± 2.6 vs. dexmedetomidine 0.6 ± 1.4 at 30 min; placebo 1.2 ± 2.1 vs. Dexmedetomidine 0.3 ± 0.6 at 60 min; both P <0.01) without any significant adverse effects.[20] Similar results were observed by Lamontagne C et al who reported reduced mean duration of shivering to 2.6 (±2.1) min after a single 30µg intravenous dexmedetomidine bolus as compared to 17.9 (±12.6) min after saline administration in control group.[21]

No significant adverse effects were observed. No events of bradycardia were observed in our study group and this can likely be explained by the low dose as well as by the fact that dexmedetomidine was administered at the point where the parturient was relatively tachycardic due to the administration of oxytocin. No perioperative sedation was observed among the study group parturients in our study which is in contrast to the study done by Nesioonpour S et al who observed increase in the mean sedation score during 10-30 mins (p=0.003) in dexmedetomidine group as compared to the placebo group.[22]

This present study had limitations, such as the small sample size and not evaluating the core body temperature. Therefore, further multicenter studies with a larger sample size are recommended for more accurate results.

Conclusion :

The results of the present study suggested that the intravenous administration of low dose Dexmedetomidine could effectively reduce the incidence of shivering in patients undergoing C-sections without significant complications. Henceforth, intravenous dexmedetomidine could be used as an effective and safe medicine in preventing shivering and reducing patient discomfort in women undergoing C-sections.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

References

1. Glosten B, Sessler DI, Faure EA, Karl L, Thisted RA. Central temperature changes are poorly perceived during epidural anesthesia. Anesthesiology 1992; 77: 10-6.
2. Ozaki M, Kurz A, Sessler DI, Lenhardt R, Schroeder M, Moayeri A, Noyes KM, Rotheneder E. Thermoregulatory thresholds during epidural and spinal anesthesia. Anesthesiology 1994; 8: 282-8
3. Kishore N, Payal YS, Kumar N, Chauhan N. In Spinal Anaesthesia for Cesarean Section the Temperature of Bupivacaine Affects the Onset of Shivering but Not the Incidence: A Randomized Control Trial. J Clin Diagn Res 2016; 10(1): 18-21.
4. Crowley LJ, Buggy DJ. Shivering and neuraxial anesthesia. Reg Anesth Pain Med 2008; 33: 241-52
5. Tsai YC, Chu KS. A comparison of tramadol, amitriptyline, and meperidine for postepidural anesthetic shivering in parturients. Anesth Analg 2001; 93: 1288-92
6. Macintyre PE, Pavlin EG, Dwersteg JF. Effect of meperidine on oxygen consumption, carbon dioxide production, and respiratory gas exchange in postanesthesia shivering. Anesth Analg 1987; 66: 751.
7. De Witte J, Sessler DI. Perioperative shivering: physiology and pharmacology. Anaesthesia 2002; 96: 467-84.
8. Elvan EG, Oç B, Uzun S, Karabulut E, Co?kun F, Aypar U. Dexmedetomidine and postoperative shivering in patients undergoing elective abdominal hysterectomy. Eur J Anaesthesiol 2008; 255: 357-64
9. Omar H, Aboella WA, Hassan MM, Hassan A, Hassan P, Elshall A, et al. Comparative study between intrathecal dexmedetomidine and intrathecal magnesium sulfate for the prevention of post-spinal anaesthesia shivering in uroscopic surgery; (RCT). BMC Anesthesiol 2019; 19(1): 190.
10. Kurz A, Sessler I, Schroeder M, Kurz M. Thermoregulatory response thresholds during spinal anaesthesia. Anesth Analg 1993; 77: 721-6
11. Witte JD, Sesler DI. Perioperative shivering. Anesthesiology 2002; 96: 467-84.
12. Schwarzkopf KR, Hoff H, Hartmann M, Fritz HG. A comparison between meperidine, clodine and urapidil in the treatment of postanesthetic shivering. Anesth Analg 2001; 92: 257-60.
13. Lenhardt R, Orhan-Sungur M, Komatsu R, Govinda R, Kasuya Y, Sessler DI, et al. Suppression of shivering during hypothermia using a novel drug combination in healthy volunteers. Anesthesiology 2009; 111: 110-5
14. Ezz G, Fathi HM, Abd Eldayem HM. Effect of intrathecal dexmedetomidine on the quality of combined spinal epidural analgesia and obstetric outcome during vaginal delivery. Res Opin Anesth Intensive Care 2017; 4: 23-8
15. Li C, Wu Y, Fan J. Effect of two different times for intravenous dexmedetomidine alleviates shivering during parturients cesarean delivery under combined spinal-epidural anaesthesia. J Clin Anesthesiol 2017; 33: 868-71.
16. Usta B, Gozdemir M, Demircioglu RI, Muslu B, Sert H, Yaldiz A. Dexmedetomidine for the prevention of shivering during spinal anesthesia. Clinics (Sao Paulo) 2011; 66: 1187-91.
17. Abdel-Ghaffar HS, Mohamed SA, Fares KM, Osman MA. Safety and efficacy of dexmedetomidine in treating post spinal anesthesia shivering: a randomized clinically controlled dose-finding trial. Pain Physician 2016; 19: 243-53.
18. Bicer C, Esmaoglu A, Akin A, Boyaci A. Dexmedetomidine and meperidine prevent postanaesthetic shivering. Eur J Anaesthesiol 2006; 232: 149-53.
19. Coskuner I, Tekin M, Kati I, Yagmur C, Elcicek K. Effects of dexmedetomidine on the duration of anaesthesia and wakefulness in bupivacaine epidural block. Eur J Anaesthesiol 2007; 24: 535-40
20. Sween LK, Xu S, Li C, O'Donoghue MA, Ciampa EJ, Kowalczyk JJ, Li Y, Hess PE. Low-dose intravenous dexmedetomidine reduces shivering following cesarean delivery: a randomized controlled trial. Int J Obstet Anesth. 2021 ; 45: 49-55.
21. Lamontagne C, Lesage S, Villeneuve E, Lidzborski E, Derstenfeld A, Crochetière C. Intravenous dexmedetomidine for the treatment of shivering during Cesarean delivery under neuraxial anesthesia: a randomized-controlled trial. Can J Anaesth 2019 ; 66(7): 762-71.
22. Nesioonpour S, Bayat S, Ghomeishi A, Behaeen K, Savaie M, et al. Effect of Intravenous Dexmedetomidine on Shivering in Cesarean Section under Intrathecal Anesthesia: Randomized Clinical Trial. Anesth Pain Med. 2022; 12(3): e122735