A COMPARISON OF TRAMADOL AND PETHIDINE FOR CONTROL OF SHIVERING DURING CAESAREAN SECTION UNDER SPINAL ANAESTHESIA

Taznim Mohamed[1], Vadakkoot Raghavan Hema[2]

[1]Associate Professor, Department of Anaesthesiology, Government Medical College, Kozhikode, Kerala.
[2]Associate Professor, Department of Anaesthesiology, Government Medical College, Kozhikode, Kerala.

ABSTRACT

BACKGROUND

Shivering is an unpleasant complication of regional anaesthesia. Both tramadol and pethidine have been found to be effective in suppressing shivering. The aim of our study was to compare the efficacy of equipotent doses of tramadol and pethidine for control of shivering in patients undergoing spinal anaesthesia.

MATERIALS AND METHODS

A randomized double blind study was conducted on 60 patients undergoing Caesarean section who developed shivering during spinal anaesthesia. Approval was obtained from the Institutional Ethics Committee. The patients were randomly allocated to two groups of 30 each. Group T (n=30) received tramadol 0.5 mg/kg and Group P (n=30) received pethidine 0.5 mg/kg at the onset of shivering. The parturient was asked to assess the effect of treatment. The anaesthesiologist independently noted the time taken for shivering to subside. The degree of sedation and incidence of nausea and vomiting were also noted. The quantitative variables were compared using the unpaired t test and the qualitative variables using the Chi- Square test.

RESULTS

A total of 64% of patients in Group T and 86% in Group P noted improvement (P=0.003) at 5-minutes after drug administration. 43.3% in Group T had their shivering controlled compared to 83.3% in Group P (P=0.001) as assessed by the Anaesthesiologist. Sedation was more with pethidine than tramadol. The incidence of nausea was comparable, and no vomiting occurred in either group.

CONCLUSION

Pethidine 0.5 mg/kg is superior to tramadol 0.5 mg/kg when used for the control of intraoperative shivering under spinal anaesthesia though it can produce more sedation.

KEYWORDS

Shivering, Spinal Anaesthesia, Caesarean Section, Tramadol, Pethidine.

HOW TO CITE THIS ARTICLE: Taznim M, Hema VR. A comparison of tramadol and pethidine for control of shivering during caesarean section under spinal anaesthesia. J. Evid. Based Med. Healthc. 2018; 5(30), 2231-2234. DOI: 10.18410/jebmh/2018/462

BACKGROUND

Spinal anaesthesia is a safe and popular technique for Caesarean Section. Shivering is a common side effect which can be distressing to the patient. It also tends to produce a 3 to 4-fold increase in oxygen consumption, precipitate arterial hypoxemia and lactic acidosis, raise intraocular and intracardiac pressures and produce artifacts in monitors.[1]

Among the drugs used for the suppression of shivering, both pethidine and tramadol have been found to be effective and act by reducing the shivering threshold. Pethidine has been found to control shivering with doses as low as 0.35 mg/kg.[2] Tramadol has been used as an analgesic for labour pain without producing neonatal depression.[3] This property of tramadol makes it an attractive alternative to pethidine for the suppression of shivering in the obstetric population. Mechanisms other than opioid receptor activity including activation of monoaminergic pathways in spinal cord and agonistic properties on α- 2 receptors in cerebrum and pons play a significant role in the analgesia produced by tramadol.[4]

Tramadol and pethidine are equipotent analgesics.[5,6] Tramadol has been found to control shivering at doses of 0.5 mg/kg.[7] But it can produce nausea and vomiting. The aim of our study was to compare the efficacy of tramadol and pethidine at a dose of 0.5 mg/kg for the suppression of shivering in obstetric patients undergoing spinal anaesthesia for Caesarean section.

MATERIALS AND METHODS

Institutional Ethics Committee approval was obtained prior to the start of the study. It was a randomized double-blind study. ASA I/II patients who were administered spinal anaesthesia for Caesarean section and subsequently

Financial or Other, Competing Interest: None.
Submission 01-07-2018, Peer Review 03-07-2018,
Acceptance 20-07-2018, Published 23-07-2018.
Corresponding Author:
Dr. Vadakkoot Raghavan Hema,
C1 Quarters, Government Medical College Campus,
Kozhikode- 673008, Kerala.
E-mail: drhemavr@gmail.com
DOI: 10.18410/jebmh/2018/462

developed shivering were included in the study. Informed written consent was obtained from all patients.

Patients with known hypersensitivity to either drug, with initial body temperature <36.5^{0}C or >38^{0}C (as measured using an oral mercury thermometer), history of substance abuse, history of intake of monoamine oxidase inhibitors were excluded. Patients who had inadequate levels of block and required anaesthetic supplements and those with level of block above T4 (as assessed by pinprick) were also excluded.

Aspiration prophylaxis was administered with ranitidine and metoclopramide 50 minutes prior to the surgery. Subarachnoid block was administered using 0.5% bupivacaine heavy in all cases. The quantity and type of intravenous fluids, ephedrine administration and dose of local anesthetic were titrated according to patient requirement. We did not attempt to control these factors. The fluids and drugs were kept at room temperature. The operating room temperature was kept constant at 24^{0}C. A cotton sheet was used to cover the upper trunk and arms in all patients. Standard monitoring of noninvasive blood pressure (NIBP), electrocardiograph and pulse oximeter was used.

Sample size chosen for the study was based on assuming the power of 80%, 95% confidence level and statistically significant difference between the two groups based on a previous study.[8] A total of 60 patients were included in the study and Group T (n=30) received tramadol hydrochloride 0.5 mg/kg and Group P (n=30) received pethidine hydrochloride 0.5 mg/kg at the onset of shivering. Shivering was taken as any noticeable fasciculation of the face, jaw, head, trunk or extremities lasting longer than 15 seconds. Even if the patient developed shivering before delivery of the baby, the drug was administered only after delivery.

The effect on shivering was assessed both by the patient and the anaesthesiologist. Five minutes after the drug administration, the parturient was asked to evaluate the effect of treatment as no improvement, slight improvement or marked improvement. The anaesthesiologist independently noted the time taken for shivering to subside. Failure of shivering to subside after 15 minutes was considered as ineffective response. Recurrence of shivering was also noted till the patient left the recovery room.

The degree of sedation after 15-minutes of drug administration was also graded on a three-point scale, where 0= No sedation, 1= mildly sedated, easily arousable and 2= heavily sedated. The patient was also specifically asked for feelings of nausea or dizziness. The presence of vomiting if any was noted. The NIBP, pulse rate and oxygen saturation (SpO2) were recorded every 5-minutes.

Statistical Analysis: The numerical data were compared using the unpaired Student's t-test and reported as mean ± standard deviation (SD). The categorical variables were compared by the Chi-square test and reported as numbers and percentages. A P value of 0.05 or less was set for assessing the statistical significance. Analysis was done by using the PASW statistics for Windows, Version 18 (Chicago. SPSS Inc, IBM Corp. 2010).

RESULTS

Sixty patients who developed shivering during Caesarean section under spinal anaesthesia were included in the study and assigned to Group T (n = 30) and Group P (n = 30). There was no statistically significant difference among the groups with respect to demographic characteristics (Table 1).

Variable	Group T	Group P	P
Age (years)	25.1 ± 12	25.5 ± 13.5	0.765
Weight (kg)	54.87 ± 18.5	53.2 ± 20	0.193
Body Temperature (^{0}C)	36.8 ± 1.2	37.1 ± 0.8	0.762

Table 1. Demographic Variables

	Group T	Group P	Total
Time of Onset of Shivering (No. of Patients)			
Before delivery	5	11	16
After delivery	25	19	44
Interval between Onset of Shivering and Drug Administration (in minutes)			
	3.1 ± 1.2	6.27 ± 2.3	P= 0.061

Table 2. Time of Onset of Shivering and Drug Administration

No. of Patients	No Improvement	Slight Improvement	Marked Improvement
Group T	11	8	11
Group P	4	2	24

Table 3. Patient Assessment of Improvement at 5 minutes of Administering Study Drug (P=0.003)

No. of Patients	No Sedation	Mild Sedation	Marked Sedation
Group T	26	4	0
Group P	4	26	*0*

Table 4. Sedation Assessed at 15 minutes

The onset of shivering was after the delivery of the baby in 73.3% of patients and before in 26.7% of patients (Table 2). The interval between the onset of shivering and administration of study drug was not found to influence the outcome of the study (P= 0.866) (Table 2).

Patient assessment of improvement at 5 minutes is shown in Table 3. A total of 64% of patients in Group T and 86% in Group P noted improvement (P=0.003). Efficacy of the drug as assessed by control of shivering within 15 minutes was as follows: 43.3% in Group T had their shivering controlled compared to 83.3% in Group P (P=0.001). Sedation assessed at 15 minutes is shown in Table 4. There was no incidence of marked sedation in either group.

Mean time for control of shivering was 3.71 minutes for Group T and 2.92 minutes for Group P (P=0.190). Two

patients in Group T and none in Group P had nausea (P= 0.150). There was no incidence of vomiting in either group. Recurrence was noted in both groups after initial control. 61% in Group T and 40% in Group P had recurrence (P= 0.207).

The mechanism of shivering during regional anaesthesia is still an enigma. A decrease in core temperature as well as false information from receptors may contribute. Peripheral vasodilatation and heat loss from skin due to sympathetic blockade,[9] cold operating room, cold intravenous fluids, direct effect of cold anaesthetic solutions on thermosensitive structures in the spinal cord,[10] etc. produce a decrease in body temperature.

Although regional anaesthesia typically causes core hypothermia, patients often feel warmer after the induction of anaesthesia.[11,12] This sensation of increased comfort, like the inhibition of autonomic defenses, presumably results from the thermoregulatory system's incorrect evaluation of skin temperature in the blocked area. Because medical personnel rarely monitor the core temperature during regional anaesthesia, hypothermia can go undetected. The thresholds for shivering and vasoconstriction fall by approximately 0.5^0C during regional anaesthesia[13] and this can be compounded with concomitant administration of sedatives.

A patient who becomes sufficiently hypothermic during spinal or epidural anaesthesia will shiver. Patients find this disturbing and it produces little heat, because only the muscle mass in the unblocked areas is involved.

Treatment modalities include forced air warming which is the most effective method,[14] use of warm intravenous fluids[15] and anaesthetic agents and intravenous as well as extradural administration of various drugs.[16]

In our study, we tried to standardize the possible compounding factors. Operating room temperature was maintained at 24^0C, intravenous fluids were administered at room temperature and a single layer of cotton sheet was used to cover the upper part of the patient's body. Body temperature was recorded at the start of the operation.

The analgesic effect of tramadol is attributed to its agonism on opioid receptors. It activates the monoaminergic receptors of the descending spinal inhibitory pathways of pain. The main opioid effect of tramadol is mediated by the μ-receptor, with some effect on κ or δ binding sites. It inhibits noradrenaline and serotonin uptake at the synaptosomes, which contributes to its analgesic effect.[4] This, as well as its agonism for the α-2 receptors in cerebrum and pons, may contribute to its ant shivering action.[17]

Pethidine decreases the shivering threshold about twice as much as the vasoconstriction threshold.[18] The gain as well as the maximum intensity of shivering remains unchanged. The anti-shivering effect may be due to its affinity for the κ-receptor. Other possible mechanisms include inhibition of biogenic monoamine reuptake, NMDA receptor antagonism or stimulation of α-2 adrenoreceptors.[19]

In our study, at equipotent dose, pethidine was found to be superior to tramadol for the suppression of shivering by objective assessment. The difference was less when it came to subjective improvement, but pethidine was definitely superior. Bhatnagar S, et al[8] found that tramadol 1 mg/kg was superior to 0.5 mg/kg of pethidine for the treatment of postoperative shivering. But, the study was carried out in postoperative patients undergoing general anaesthesia. The dose of tramadol used was also high.

The results of our study are similar to that carried out by Sharma M, et al[20] in patients undergoing regional anesthesia and Gangopadhyay et al.[21] The incidence of nausea reported was more with tramadol.

An earlier study by Tsai and Chu compared tramadol, amitriptyline and pethidine for post epidural anaesthetic shivering.[22] They found both tramadol and pethidine to be more effective than amitriptyline, but pethidine proved to be only slightly better than tramadol (93% and 87% effectiveness respectively). However, our study showed a statistically significant difference between the two drugs when given during spinal anaesthesia for Caesarean section. We did not attempt to strictly control the various factors which might have influenced the occurrence of shivering, such as the bupivacaine dose or the temperature of drugs and intravenous fluids administered. However, these would not have influenced the outcome of our study as we focused on the response to treatment, rather than the occurrence of shivering. Besides the two study groups have been subjected to a similar degree of influence of these factors by randomization.

Tramadol offers the advantage of less sedation and therefore, less neonatal depression. It could be administered before the delivery to a shivering parturient though in our study, it was administered only afterwards.

The anti-shivering effect of these drugs may be synergistic. In both groups, shivering recurred after initial control. Further studies are needed to evaluate the effect of repeat doses when shivering recurred.

CONCLUSION

Pethidine 0.5 mg/kg is superior to tramadol 0.5 mg/kg when used for the control of shivering under spinal anaesthesia, though it can produce more sedation. Nausea, vomiting and recurrence of shivering are comparable between these drugs at this dose.

Acknowledgement

We would like to thank all staff and residents of Government Medical College, Kozhikode who helped in the smooth conduct of the study.

REFERENCES

[1] Ralley FE, Wynands JE, Ramsay JG, et al. The effects of shivering on oxygen consumption and carbon dioxide production in patients rewarming from hypothermic cardiopulmonary bypass. Can J Anaesth 1988;35(4):332-337.

[2] Wrench IJ, Singh P, Dennis AR, et al. The minimum effective doses of pethidine and doxapram in the treatment of post-anaesthetic shivering. Anaesthesia 1997;52(1):32-36.

[3] Viegas OA, Khaw B, Ratnam SS. Tramadol in labour pain in primiparous patients. A prospective comparative clinical trial. Eur J Obstet Gynecol Reprod Biol 1993;49(3):131-135.
[4] Driessen B, Reimann W. Interaction of the central analgesic, tramadol, with the uptake and release of 5-hydroxytryptamine in the rat brain in vitro. Br J Pharmacol 1992;105(1):147-151.
[5] Vickers MD, O'Flaherty D, Szekely SM, et al. Tramadol: pain relief by an opioid without depression of respiration. Anaesthesia 1992;47(4):291-296.
[6] Jabalameli M, Safavi M, Honarmand A, et al. The comparison of intraincisional injection tramadol, pethidine and bupivacaine on postcesarean section pain relief under spinal anesthesia. Adv Biomed Res 2012;1:53.
[7] Chan AM, Ng KF, Tong EW, et al. Control of shivering under regional anesthesia in obstetric patients with tramadol. Can J Anaesth 1999;46(3):253-258.
[8] Bhatnagar S, Saxena A, Kannan TR, et al. Tramadol for postoperative shivering: a double-blind comparison with pethidine. Anaesth Intensive Care 2001;29(2):149-154.
[9] Chamberlain DP, Chamberlain BD. Changes in skin temperature of the trunk and their relationship to sympathetic blockade during spinal anesthesia. Anesthesiology 1986;65(2):139-143.
[10] Walmstey AJ, Giesecke AH, Lipton JM. Contribution of extradural temperature to shivering during extradural anaesthesia. Br J Anaesth 1986;58(10):1130-1134.
[11] Emerick TH, Ozaki M, Sessler DI, et al. Epidural anesthesia increases apparent leg temperature and decreases the shivering threshold. Anesthesiology 1994;81(2):289-298.
[12] Leslie K, Sessler DI. Reduction in the shivering threshold is proportional to spinal block height. Anesthesiology 1996;84(6):1327-1331.
[13] Kurz A, Sessler DI, Schroeder M, et al. Thermoregulatory response thresholds during spinal anesthesia. Anesth Analg 1993;77(4):721-726.
[14] Kurz A, Kurz M, Poeschl G, et al. Forced-air warming maintains intraoperative normothermia better than circulating-water mattresses. Anesth Analg 1993;77(1):89-95.
[15] Webb PJ, James FM, Wheeler AS. Shivering during epidural analgesia in women in labor. Anesthesiology 1981;55(6):706-707.
[16] Sutherland J, Seaton H, Lowry C. The influence of epidural pethidine on shivering during lower segment caesarean section under epidural anaesthesia. Anaesth Intensive Care 1991;19(2):228-232.
[17] Scholz J, Tonner PH, Krause T, et al. Interactions of intravenous anesthetics with cerebralalpha-2-adrenoceptors. Anasthesiol Intensivmed Notfallmed Schmerzther 1999;34(10):642-647.
[18] Kurz A, Ikeda T, Sessler DI, et al. Meperidine decreases the shivering threshold twice as much as the vasoconstriction threshold. Anesthesiology 1997;86(5):1046-1054.
[19] Takada K, Clark DJ, Davies MF, et al. Meperidine exerts agonist activity at the alpha(2B)-adrenoceptor subtype. Anesthesiology 2002;96(6):1420-1426.
[20] Sharma M, Kharbuja K, Khadka B. Comparison of pethidine and tramadol for the control of shivering in patients undergoing elective surgery under spinal anesthesia. Journal of Lumbini Medical College 2016;4(2):64-67.
[21] Gangopadhyay S, Gupta K, Acharjee S, et al. Ketamine, tramadol and pethidine in prophylaxis of shivering during spinal anaesthesia. J Anaesth Clin Pharmacol 2010;26(1):59-63.
[22] Tsai YC, Chu KS. A comparison of tramadol, amitriptyline, and meperidine for post epidural anesthetic shivering in parturients. Anesth Analg 2001;93(5):1288-1292.