Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

Original research article

A hospital-based study comparing the efficacy of prophylactic granisetron on postanaesthetic shivering in comparison to pethidine

[1]Dr. Sameera, [2]Dr. Pradeep, [3]Dr. Syed Himayathulla Hussaini

[1, 3]Assistant Professor, Department of Anaesthesiology, ESIC PGIMSR, Kalaburagi, Karnataka, India

[2]Senior resident, Department of Anaesthesiology, ESIC PGIMSR, Kalaburagi, Karnataka, India

Corresponding Author:

Dr. Syed Himayathulla Hussaini

Abstract

Aim: The aim of the present study was to compare the efficacy of prophylactic granisetron on postanaesthetic shivering in comparison to pethidine.

Methods: The present study was conducted in the Department of Anaesthesia and we selected 200 patients aged 20–50 year, American Society of Anesthesiologist (ASA) physical Status I and II, scheduled for lower abdominal surgery under spinal anaesthesia. The patients were randomly allocated to Group P (n = 100) receiving pethidine 0.4 mg/kg and Group G (n = 100) receiving granisetron 40 mcg/kg intravenous (IV) as study drug before spinal anesthesia.

Results: The three groups had similar characteristics in terms of age, weight, height, gender, length of anaesthesia, duration of surgery, and ASA physical state. The incidence of postoperative shivering upon arrival in the recovery room, 15 minutes after arrival, was lower in Group G than Group P, which was not statistically significant (p>0.05). However, in Group G and Group P, 4 and 10 patients, respectively, had grade 3 shivering. Nevertheless, there were no notable disparities in the central body temperature among the patients before to and during the administration of anaesthesia.

Conclusion: Prophylactic administration of granisetron at a dosage of 40 mcg/kg intravenously is as effective as pethidine at a dosage of 0.4 mg/kg in preventing shivering after spinal anaesthesia during surgery. Additionally, granisetron helps maintain higher levels of core temperature and oxygen saturation compared to pethidine. Prophylactic use of granisetron also decreases the need for antiemetic medications.

Keywords: Shivering, postoperative, granisetron, pethidine

Introduction

Shivering is a frequently seen issue during the perioperative period. Shivering is an uncomfortable experience that leads to several unfavourable physiological effects, including increased oxygen use, carbon dioxide generation, heightened risk of cardiac ischemia, infection, bleeding, and an increase in minute ventilation [1] Additionally, it causes hypoxemia, lactic acidosis, elevated intraocular pressure, intracranial pressure (ICP), and disrupts patient monitoring methods such as electrocardiogram (ECG), noninvasive blood pressure (NIBP), and SpO2 [1]. Additionally, it impacts the process of monitoring and leads to an elevation in both intraocular and intracranial pressure [2, 3]. Perioperative hypothermia continues to be prevalent despite extensive attempts to avoid it [4, 5]. The primary causes of shivering during and after surgery are a decrease in body temperature, a decrease in sympathetic nervous system activity, and the release of pyrogens [6]. The occurrence rate is 60% after general anaesthesia and may go up to 33% after regional anaesthesia [7].

Spinal anaesthesia is recognised for its ability to lower the threshold for shivering, which is preceded by a fall in core body temperature and constriction of blood vessels above the area where the anaesthesia is applied [8]. Regional anaesthesia causes vasodilation, which helps transfer heat from the centre of the body to the periphery. Additionally, it resulted in an elevation of the sweating threshold and a decrease in both vasoconstriction and shivering thresholds. Preventing or reducing perioperative and especially postoperative shivering may lower the likelihood of negative outcomes associated with perioperative shivering and can decrease the patient's stay in the post-anesthesia care unit (PACU).

Both pharmacological and non-pharmacological methods may be used to manage perioperative shivering. Non-pharmacological techniques include the use of fluid warmers, monitoring the ambient temperature of the operating theatre, using space blankets, and utilising surgical drapes. Pharmacological approaches include a range of medications, including opioids (such as pethidine, pentazocine, and tramadol), α2 agonists (such clonidine and ketanserin), as well as additional medicines like as doxapram, neofam, neostigmine, and magnesium sulphate, which have been tested [9].

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

Pethidine, a well-established medication for shivering control, may have negative consequences including respiratory depression, nausea, and vomiting. This prompts an inquiry into the effectiveness of alternative medications. Serotonin, a biogenic amine present in the brain and spinal cord, plays a function in neurotransmission. Research indicates that the serotonergic system is involved in regulating postanaesthetic shivering [10]. Granisetron, a kind of medication that blocks the 5-HT3 receptors, has been shown to be successful in preventing sensations of nausea and vomiting [11, 12].
The objective of this research was to evaluate the effectiveness of prophylactic granisetron with pethidine, an established medication for treating and preventing postanaesthetic shivering, in order to determine their relative efficacy.

Materials and Methods
The present study was conducted in the Department of Anaesthesiology and we selected 200 patients aged 20–50-year, American Society of Anaesthesiologists (ASA) physical Status I and II, scheduled for lower abdominal surgery under spinal anaesthesia.
The patients were randomly allocated to Group P (n = 100) receiving pethidine 0.4 mg/kg and Group G (n = 100) receiving granisetron 40 mcg/kg intravenous (IV) as study drug before spinal anesthesia.
Patients with cardiopulmonary disease, psychological disorder, and thyroid disorders, patients who are likely to receive blood transfusion intraoperatively and with body temperature more than 38 °C or <36.5 °C were excluded from the study.

Methodology
Standardized monitoring was done throughout the perioperative period. Heart rate, NIBP, respiratory rate, and oxygen saturation were recorded during the surgery. Core body temperature was measured by tympanic thermometer, and skin temperature was measured using skin probe. Operation room temperature was maintained at 24 °C by air-conditioning. Peripheral IV access is secured using 18-gauge cannula. All patients preloaded with warm Ringer's lactate solution of 10 ml/kg before spinal anaesthesia. Patients received respective drugs intravenously before spinal anaesthesia. Patients from both the groups received 0.5% hyperbaric bupivacaine 15 mg intrathecally with the help of 26 or 27 G Quincke's spinal needle at L3–L4 interspace in the lateral position. After subarachnoid block, the patients were turned to the supine position. Patients received oxygen 6 L/min by face mask throughout the procedure. Except surgical field patients were properly covered with cotton drapes. The hypotension if following spinal injection was treated by increasing the rate of IV fluid administration and by injection of Mephentermine 3–6 mg IV. An anaesthesiologist blinded for the study drug observed the patients for shivering, pain, nausea, and vomiting. Heart rate, NIBP, oxygen saturation, and temperature were measured and recorded on admission and every 15 min up to 6 h. The shivering was graded using a 5-item scale [19]. The possible side effects of the study drug (i.e., nausea, vomiting, hypotension, tachycardia, dry mouth, and dizziness) were recorded. In the recovery room also all patients were monitored, received oxygen through facemask and were covered with woollen blanket. Patient with nausea and vomiting were treated with metoclopramide 10 mg. Tramadol 1 mg/kg was kept as rescue medication to treat the shivering more than Grade II on 5-item scale.
Statistical analysis of data was done usingIBM corp. Released 2013. IBM SPSS statistics for windows. Version 22.0. Armonk, NY.

Results

Table 1: Patient characteristics of the two treatment groups

Variables	Group G	Group P	*P* value
Age	42.58	41.39	0.4668
Sex (M/F)	20/80	0/100	0.1248
Weight	55.65	53.87	0.1588
Height	152.58	153.57	0.9364
ASA (I/II)	40/10	42/8	0.9988

The two groups were comparable regarding distribution of age, weight, height, gender, duration of anaesthesia, duration of operation and ASA physical status.

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

Table 2: Number of patients with different grades of shivering in the two treatment groups after arrival in recovery room in 15 minute

	Group G	Group P	*P* value
0	80	70	<0.05
1	7	12	<0.05
2	7	6	<0.05
3	6	12	<0.05
4	0	0	<0.05

The number of patients with postoperative shivering on arrival in the recovery room, 15 minutes after arrival, was less in Group G than Group P. There was no statistically significant difference between Group P and G (p> 0.05). However, in Group G and Group P, 4 and 10 patients reached grade 3 shivering respectively.

Table 3: Variation in core temperature (°c)

	OR temperature	Group G	Group P	P Value
Pre-operative	21-22 ℃	35.5±0.44	36.4±0.36	>0.05
Post-operative	21-22 ℃	34.46±0.16	34.56±0.24	>0.05

However, there were no significant differences in the core temperature amongst the patients before and after the anaesthesia.

Discussion

Shivering, an adverse event course during course of anaesthesia, has an incidence of 60% following GA and up to 33% following regional anaesthesia [13]. Shivering is unpleasant and causes several undesirable physiologic consequences such as increase in oxygen consumption, carbon dioxide production, increased chances of myocardial ischemia, infection, bleeding, and increase in the minute ventilation. It also induces hypoxemia, lactic acidosis, increased intraocular pressure, intracranial pressure (ICP), and interferes with patient monitoring such as electrocardiogram (ECG), noninvasive blood pressure (NIBP), and SpO_2. Spinal anaesthesia is known to decrease the shivering threshold, preceded by core hypothermia and vasoconstriction above the level of block [14]. Various methods are available for the control of shivering such as nonpharmacological or pharmacological. Nonpharmacological preventing measures such as fluid warmers, maintaining ambient operating room temperature, space blankets, surgical drapes, and active circulating water mattress have been used. Pharmacological methods include various drugs such as opioids (pethidine, pentazocine, and tramadol), α2 agonists (clonidine, ketansarin), others such as doxapram, neofam, neostigmine, and magnesium sulfate have been tried [15].

The two groups were comparable regarding distribution of age, weight, height, gender, duration of anaesthesia, duration of operation and ASA physical status. The number of patients with postoperative shivering on arrival in the recovery room, 15 minutes after arrival, were less in Group G than Group P. There was no statistically significant difference between Group P and G (p> 0.05). Pethidine has been shown to be one of the most effective treatments to prevent postoperative shivering at a dose of 0.4 mg/kg. The antishivering effect of pethidine is due to stimulation of kappa receptors and drug induced decrease in the shivering threshold. In addition, pethidine is a potent alpha two receptor agonist which contributes to antishivering effects. Butorphanol - A kappa receptor agonist - antagonist stops shivering more effectively than opioids with a predominant mu opioid receptor agonist effect. Evidence for a role of kappa receptors in the antishivering effects of meperidine and butorphanol is the failure of naloxone to completely inhibit this drug induced effect. A disadvantage of pethidine is that it can cause respiratory depression in the presence of previously administered opioids or anaesthetics. Moreover, nausea and vomiting are also important adverse effects of pethidine [16, 17].

Powell and Colleagues [24==18] reported that after general anaesthesia, shivering was determined in 57%, 33% and 15% of patients in control, ondansetron 4 mg and 8 mg respectively. Similarly, Bock and colleagues [19] mentioned in their study report that dolasetron 1 mg. kg-1 decreases the incidence of shivering from 62% to 27%. However, in Group G and Group P only 4 and 10 patients reached grade 3 shivering respectively. However, there were no significant differences in the core temperature amongst the patients before and after the anaesthesia. Cutaneous warming is also the most effective means of preventing intraoperative hypothermia, so patients are covered with cotton drapes [14]. Saito *et al*. reported that hypothermia is likely to develop faster during spinal anaesthesia due to impairment of thermoregulation. A natural consequence of the rapid temperature decreases during spinal anaesthesia is that the shivering threshold will be reached sooner and that more shivering will be required to prevent further hypothermia [20].

Conclusion

Prophylactic administration of granisetron at a dosage of 40 mcg/kg intravenously is as effective as

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 11, 2023

pethidine at a dosage of 0.4 mg/kg in preventing shivering after spinal anaesthesia during surgery. Additionally, granisetron helps maintain higher levels of core temperature and oxygen saturation compared to pethidine, which was not statistically significant. Prophylactic use of granisetron also decreases the need for antiemetic medications.

References

1. Kabade SD, Venkatesh Y, Karthik SL, Kumar V. Comparative study of granisetron versus pethidine for the prevention of perioperative shivering under spinal Anesthesia. Karnataka Anaesthesia Journal. 2016 Jan 1;2(1):14-8.
2. De Witte J, Sessler DI. Perioperative shivering: physiology and pharmacology. The Journal of the American Society of Anesthesiologists. 2002 Feb 1;96(2):467-84.
3. Bhattacharya PK, Bhattacharya L, Jain RK, Agarwal RC. Post anaesthesia shivering (PAS): A review. Indian journal of anaesthesia. 2003 Mar 1;47(2):88-93.
4. Warttig S, Alderson P, Campbell G, Smith AF. Interventions for treating inadvertent postoperative hypothermia. Cochrane Database of Systematic Reviews. 2014, (11).
5. Kinjo T, Tadokoro T, Tokushige A, Zamami T, Taira S, Ikehara Y, *et al*. Effects of perioperative administration of acetaminophen on postoperative shivering: a randomized, triple-blind, placebo-controlled trial. Anesthesia & Analgesia. 2020 Apr 1;130(4):983-90.
6. Wason R, Jain N, Gupta P, Gogia AR. Randomized double-blind comparison of prophylactic ketamine, clonidine and tramadol for the control of shivering under neuraxial anaesthesia. Indian journal of anaesthesia. 2012 Jul;56(4):370.
7. Iqbal A, Ahmed A, Rudra A, Wankhede RG, Sengupta S, Das T, *et al*. Prophylactic granisetron vs pethidine for the prevention of postoperative shivering: A randomized control trial. Indian J Anaesth. 2009;53:330-4.
8. Buggy DJ, Crossley AW. Thermoregulation, mild perioperative hypothermia and postanaesthetic shivering. Br J Anaesth. 2000;84:615-28.
9. Díaz M, Becker DE. Thermoregulation: physiological and clinical considerations during sedation and general anesthesia. Anesthesia progress. 2010 Mar 1;57(1):25-33.
10. Alfonsi P. Postanaesthetic shivering: epidemiology, pathophysiology, and approaches to prevention and management. Drugs. 2001 Dec;61:2193-205.
11. Fujii Y, Tanaka H, Toyooka H. Granisetron prevents nausea and vomiting during spinal anaesthesia for caesarean section. Acta anaesthesiologica scandinavica. 1998 Mar;42(3):312-5.
12. Biswas BN, Rudra A. Comparison of granisetron and granisetron plus dexamethasone for the prevention of postoperative nausea and vomiting after laparoscopic cholecystectomy. Acta anaesthesiologica scandinavica. 2003 Jan;47(1):79-83.
13. Iqbal A, Ahmed A, Rudra A, Wankhede RG, Sengupta S, Das T, *et al*. Prophylactic granisetron vs pethidine for the prevention of postoperative shivering: a randomized control trial. Indian journal of Anaesthesia. 2009 Jun;53(3):330.
14. Buggy DJ, Crossley AW. Thermoregulation, mild perioperative hypothermia and post-anaesthetic shivering. British journal of anaesthesia. 2000 May 1;84(5):615-28.
15. Díaz M, Becker DE. Thermoregulation: physiological and clinical considerations during sedation and general anesthesia. Anesthesia progress. 2010 Mar 1;57(1):25-33.
16. Katzung BG, Masters SB, Trevor AJ. Basic and Clinical Pharmacology. 11th Ed. New York: McGraw-Hill; c2009. p. 236.
17. Stoelting RK, Hiller SC. Pharmacology and Physiology in Anaesthetic Practice. 4th ed., Ch. 3. Philadelphia: Lippincott Williams Willing; c2006. p. 102-4.
18. Powell RM, Buggy DJ. Ondansetron given before induction of anesthesia reduces shivering after general anesthesia. Anesthesia & Analgesia. 2000 Jun 1;90(6):1423-7.
19. Bock M, Sinner B, Göttlicher M, Simon E, Martin E, Motsch J, *et al*. Involvement of serotonergic pathways in postanaesthetic cold defence: dolasetron prevents shivering. Journal of thermal biology. 2002 Apr 1;27(2):159-66.
20. Saito T, Sessler DI, Fujita K, Ooi Y, Jeffrey R. Thermoregulatory effects of spinal and epidural anesthesia during cesarean delivery. Regional Anesthesia and Pain Medicine. 1998 Jul 1;23(4):418-23.