



A CROSS SECTIONAL STUDY ON THE MAGNITUDE AND ASSOCIATED FACTORS OF INTRAOPERATIVE SHIVERING AFTER CAESAREAN DELIVERY UNDER SPINAL ANESTHESIA.

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Contributions

MF conceived, design, analyze and supervise the study.

MM performed literature review, data collection and drafted the manuscript.

LZ performed literature review, data collection, analysis and interpretation.

MK provided administrative, technical or material support.

MA assisted in data collection.

ZRF contributed to data analysis and interpretation.

All authors reviewed and approved the final version of manuscript.

Abstract

The object of this study was to determine the magnitude and associated factors of intraoperative shivering after cesarean section under spinal anesthesia in the operation theater of tertiary care hospitals (RMI and HMC Peshawar). It was conducted in the Obstetrics and Gynecology OT of tertiary care hospitals, (RMI and HMC) Peshawar, KPK. The duration of this study was 6 months (1st July, 2022 –20th December, 2022). The total sample size was 295, which was calculated by the non-defined population formula and the data was collected through a semi-structured questionnaire. Finally, the data was analyzed on SPSS version 26. A number of 295 participants were included in the study, out of which 127 experienced shivering. The total incidence of shivering was 43.1% and the factors contributing to shivering were Body mass index, maternal comorbidities (hypertension, asthma, obesity), room temperature, premedication, duration of preoperative fasting, bupivacaine dose were associated with shivering in multivariate logistic regression having P-value<0.05. Type of fluid (crystalloid or Colloid), oxygen saturation during surgery, dose of oxytocin and incidence of nausea were significantly associated with shivering in the bivariate logistic regression with P-value< 0.000. The frequency of intraoperative shivering after caesarean section delivery under spinal anesthesia was comparable to many studies i.e., 43.1%. The factors that mainly contributed to intraoperative shivering were Type of fluid, oxygen saturation during surgery, dose of oxytocin and

incidence of nausea. The peak incidence of shivering in our study was recorded in less than five minutes after caesarean delivery.

Keywords: *Shivering, Factors, Cesarian section, Spinal Anesthesia*

Introduction

Neuraxial anesthesia (NA) is one of the most common techniques used in caesarean section. It has three main types i-e spinal anesthesia, epidural anesthesia and combine spinal epidural (CSE) (1).

It provides several benefits over general anesthesia or systemic analgesia, including reduced maternal morbidity and mortality, decreased newborn depression, post-operative analgesia, less opioid-related unfavorable outcomes, and better relief from the pain and patient satisfaction. Neuraxial block causes the autonomic thermoregulation below the level of the block to be disturbed, which further causes vasodilation in the block's area. Heat is distributed more evenly as a result of this vasodilation (2)

Spinal anesthetic technique is widely used nowadays for cesarean section (3). It is preferred by the physicians and parturient due to its advantages, which are rapid start, easy to administer, higher success rate, cheap, decreased fetal and maternal drug exposure and less risk of parturient aspiration. (4).

Anesthesia has the potential to impede the physiological thermoregulatory mechanism of the body. Even small variations in the thermoregulatory mechanism can lead to cellular and tissue level dysfunction. Due to this perioperative interruption, severe postoperative complications can result which include wound infection, increase surgical bleeding and cardiac events (5).

Shivering is defined as spontaneous, involuntary, thoroughly discomforting and repetitive muscular activity (2). It is an autonomic protective reflex mechanism as a result of which heat is produced by the body through muscle contraction (6) (4). Shivering often causes unwanted complications and causes discomfort and dissatisfaction in patients undergoing surgery (6).

Yonus Admaso Ferade estimates that shivering occurs 50%–60% in the total population. (1). According to Subramani, Yamini Nagappa, and Mahesh Kumar, shivering may happen in as many as 85% of patients having a caesarean section after the administration of spinal anesthetic (7).

Shivering occurs when the threshold is achieved up to a specific level due to in decrease in body temperature. (8). Parturient have decrease shivering threshold due to high progesterone level (7).

Shivering hinders the monitoring of electrocardiogram (ECG), blood pressure, pulse oximetry and oxygen saturation. It also increases oxygen consumption, lactic acidosis and carbon dioxide production (1). It interferes with the level of wound pain and increase intraocular pressure (IOP), intracranial pressure (ICP). Nausea and vomiting are the end results of shivering which increases the risk of discomfort and dissatisfaction in parturient (6). The risk of shivering increases during childbirth because of loss of amniotic fluid during membrane rupture leading to decrease in body temperature. It has been shown that anxiety, hypotension and hypothermia can contribute to intraoperative shivering after cesarean section (8).

There are different strategies for the management of intraoperative shivering, either pharmacological or non-pharmacological (1). Common treatment methods include increase in body temperature, physical warming and increase in operating room temperature. (7).

Pharmacological treatment is considered as the first choice for the management of shivering (9). To prevent post spinal shivering drugs such as opioids, N-Methyl D-Aspartate (NMDA) antagonists, magnesium sulphate, alpha 2 agonists, cholinomimetics, 5HT3-Antagonists can be used intraoperatively (2). (1). Meperidine and pethidine are commonly used to reduce shivering (3)(4). Pethidine has been used for a long time for treatment of shivering. (4). The non-pharmacological methods include acupoint stimulation, warm fluid therapy, forced air warmers and use of warming blankets (1).

Literature review

At the anesthesiology department of the faculty of medicine and health sciences, university of Gondar in Ethiopia, a cross-sectional study was carried out. Three hundred and twenty-six patients who were given spinal anesthesia for a caesarean delivery were part of this research. The overall incidence of intraoperative shivering recorded was 51.8% Twenty minutes after the administration of spinal anesthesia, different factors were responsible for intraoperative shivering which include duration of surgery, hypothermia, hypotension, mean arterial pressure and body temperature (1).

In a sub-Saharan tertiary hospital, two hundred and seventy patients who had had emergency delivery participated in prospective observational research. ASA I and II patients were the inclusion criteria, whereas non-consenting or spinally contraindicated patients were the exclusion criteria. It was discovered that 8.15% of the population had shivering, with hypotension and hypothermia being the main contributing causes. Shivering was adequately treated with 25 mg of intravenous pethidine (Meperidine), although its typical adverse effects included tiredness, nausea, and vomiting(10)

The review included two hundred and three individuals who had spinal or general anesthesia. Investigations were done on the severity and potential contributing variables of post-anesthesia shivering. Preoperative and postoperative axillary temperatures, as well as the degree of shivering, anesthesia and surgical information, and shivering treatment techniques, were recorded every fifteen minutes during the recovery period. Overall, 26% of patients had post-anesthesia shivering. Six patients experienced degree III shivering, while twenty-five patients had grade II shivering. As a result, there was a relatively high prevalence of post-anesthesia shivering overall. Patients who didn't take opioids for postoperative analgesia and patients with high axillary temperatures were the different factors that elevated the incidence of post-anesthesia shivering (11)

A randomized, controlled, research with hundred parturient for caesarean delivery through spinal anesthesia was conducted. Parturient were separated into two categories, with category B receiving 2-2.5ml of 0.5% bupivacaine and category R receiving 0.5% ropivacaine. According to the findings, the intraoperative frequency and degree of shivering were greater in category B than in category R. The findings revealed that the frequency of shivering was linked to local anesthetics and the variation in body temperature following spinal anesthesia but not hypothermia (12)

Material and Methods

An analytical cross-sectional study was carried out from 1st September 2022 to 30th November 2022, after receiving institutional ethical approval from the research committee. The total study duration was 3 months. In this study, two hundred and ninety-five patients were observed through consecutive sampling technique following written informed consent from each study participant. The study included all the parturient who were scheduled for cesarean section through spinal anesthesia. Just after the administration of spinal anesthesia and parturition, the grade of shivering was assessed through Neuraxial shivering scale. Patient age, BMI, dose of local anesthetic, intraoperative volume administration, level of sensory block, and total time of surgery were recorded. This study includes patients undergoing caesarean section through spinal anesthesia, parturient posted for caesarean section at full term, all emergency and elective caesarean sections, patients with age limit 18 to 43 years, patients of ASA II only and patients having body temperature from 36.5°C to 37.4 °C. Furthermore, age greater than 43 years, patients of malignant hyperthermia, uncooperative patients, patients having caesarean section on general anesthesia (GA), patients of Pre-eclampsia and eclampsia, patients of hypothyroidism and hyperthyroidism, hypothermic and febrile patients, patients receiving combine spinal and epidural analgesia were excluded.

Sample size calculated via using the following formula.

$$n = (Z)^2 p (1-p) / m^2$$

Where:

n = represents the desired sample size

z = represents the standard normal distribution usually set as 1.96 (Corresponds to 95% confidence level)

p = is for population proportion (26%, 0.26) and q which is $1 - 0.26 = 0.74$

m= margin of error (which is 5% (0.05)) $n = (1.96)^2 \times (0.26 \times 0.74) / (0.05)^2 = 295$ which was the total sample size.

Through a standardized questionnaire, data was collected. For this study, we have used the SPSS version 26 for data entry. The relation between the predictor and each outcome variable were examined using a chi-squared test. The descriptive analysis was presented via texts, tables, and graphs.

Results

In this study, two hundred and ninety-five patients were included after obtaining informed consent. Almost all the included patients were ASA II, only two patients were ASA III. All patients have fulfilled the criteria for participation. The response rate was 100%. This study was conducted in the obstetrics and gynecology department of Rehman Medical Institute, Peshawar and Hayatabad Medical Complex, Peshawar from 1st September 2022 - 30th November 2022. Data against different variable was collected through a semi-structured questionnaire. The minimum age of the included patients was 18 years old and maximum age was 40 years. The most frequent diagnosis for Cesarean section is previous Cesarean section (56.6%) as shown in Table 1.

The overall incidence of shivering was 43.1% with 95% confidence interval as shown in fig.1. Among the study participants, 127 out of 295 patients developed shivering after spinal anesthesia.

To check the appropriateness of analysis model, Hosmer Lemeshow test of goodness of fit was used. In this study, maternal age, parity, type of C-section (emergency or elective), position of the patient during surgery (supine or supine-left tilt), Level of Spinal block, surgical duration and ASA status were not associated with onset of shivering. Body mass index, maternal comorbidities (hypertension, asthma, obesity), room temperature, premedication, duration of preoperative fasting, bupivacaine dose were associated with shivering in multivariate logistic regression having P-value less than 0.05. Type of fluid (crystalloid or Colloid), oxygen saturation during surgery, dose of oxytocin and incidence of nausea were significantly associated with shivering in the bivariate logistic regression with $P\text{-value} < 0.000$ as shown in Table 1.

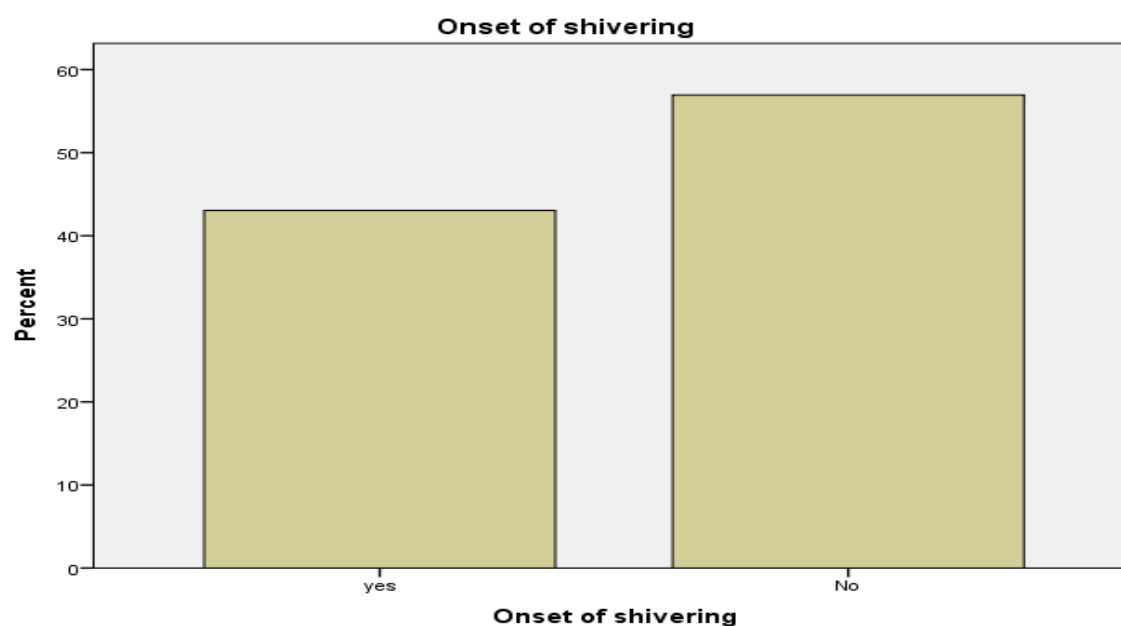


Fig.1. Incidence of intraoperative shivering after cesarean section delivery under spinal anesthesia

Table 1. Association of different factors with shivering

Maternal age, Parity, Type of C-section (emergency or elective), Position of the patient during surgery (supine or supine-left tilt), Level of Spinal block, Surgical duration, ASA status.	P value > 0.5
Body mass index, Maternal comorbidities (hypertension, asthma, obesity), Room temperature, Premedication, Duration of preoperative fasting, Bupivacaine dose.	P value <0.5
Type of fluid (crystalloid or Colloid), Oxygen saturation during surgery, Dose of oxytocin Incidence of nausea	P-value< 0.000.

Table 2. Characteristics of the study patients undergoing cesarean section under spinal Anesthesia

Variable	Characteristics	Frequency(n)	Incidence of shivering (n)
Maternal Age of Participant	18-25	97	66
	26-35	163	39
	36-40	35	27
BMI	18-24 kg/m ²	126	67
	25-28kg/m ²	156	57
	>29kg/m ²	13	08
Maternal Comorbidities	Obesity	26	12
	Asthma	3	03
	DM/HTTN	31	22
	Other comorbidities	12	8
	None	223	87
Premedication	Metoclopramide	27	14
	Dexamethasone	28	17
	Both	10	08
	None	230	93
ASA Status	ASA II	293	130
	ASA III	2	2
Bupivacaine Dose	Bupivacaine 0.75%	179	68
	Bupivacaine 0.5%	116	64
Incidence of Nausea	Absent	164	40
	Present	131	92
Room Temperature	<22C	5	5
	22-28C	275	118
	>28C	15	9

Duration of Pre-operative fasting	=6hrs	19	14
	6-8hrs	176	76
	>8hrs	72	25
	Emergency surgery	28	17
Type of Fluid transfused	Crystalloid		
	Colloid	262	105
	Crystalloid + Blood transfusion	2	2
	Colloids + Blood transfusion	17	16
Oxygen saturation	> 90%	8	8
	< 90%	275	114
		20	18

Table 3. Descriptive Statistics related to Cesarean Section

Variable	Characteristics	Frequency	Incidence of shivering
Type of C-section	Elective	253	112
	Emergency	42	20
Indication for C-Section	Previous C-section	167	77
	Fetal distress	27	14
	Malposition	39	12
	Pre-eclampsia	7	05
	Antepartum hemorrhage	1	01
	Meconium	6	04
	Others	32	10
	None of the above	8	04
	Cephalopelvic disproportion	8	5
Surgery Duration	40-60 minutes	237	101
	60-80 minutes	52	26
	80-120 minutes	6	5
Dose of Oxytocin	5-10 unit's stat, <40 units in infusion.	93	23
	10-20 unit's stat,> 40 units in infusion.	191	99
	20 units stat,> 40 units in infusion.	3	2
	IV oxytocin with additional sublingual misoprostol and intrauterine oxytocin.	8	8

Discussion

One of the most prevalent and uncomfortable adverse effects of spinal anesthesia is shivering. Shivering following spinal anesthesia has an unclear cause and mechanism. However, central thermoregulation may be the cause of shivering under spinal anesthesia. The incidence of intraoperative shivering following caesarean delivery under spinal anesthesia examined in this study (43.1%) is lower as compared to the study held in Department Of Anesthesia, College Of Medicine And Health Sciences, Ethiopia (51.8%) (1). Different variables such as level of sensory block, age of the participant, duration of anesthesia and surgery, participant's temperature were considered to increase the risk of intraoperative shivering.

In this study, among two hundred and ninety-five patients who were presented for cesarean section, one hundred and twenty-seven parturient experienced shivering after caesarean delivery. The highest percentage of intraoperative shivering was observed at the young age group i.e. maternal age 18 to 25 with onset of less than five minutes after caesarean delivery. However, previous studies also showed that young parturient had higher prevalence of shivering as compared to adult parturient (1).

The time of the procedure responsible for shivering after spinal anesthesia was the study's other major contributing component. The results of previous studies showed that the surgeries which were of longer duration i.e., greater than sixty minutes, were associated with higher prevalence of shivering. The reason was the heat loss due to longer exposure to the environment, resulted in shivering. But on the contrary in our study, 76.4% of shivering was recorded in patients who had surgery duration of forty to sixty minutes. The reason is that in our study majority of the parturient had surgery duration of forty to sixty minutes. Thus, the percentage of shivering is higher in this group as compared to previous studies in which shivering was recorded in surgeries of longer duration (1).

Another study was held at Department of Anesthesiology, Arash Women's Hospital, and Tehran University of Medical Sciences, Iran. According to this study, for spinal anesthesia, patients were given 12.5 mg of 0.5% hyperbaric bupivacaine coupled with 25 g fentanyl or 12.5 mg of 0.5% hyperbaric bupivacaine mixed with 0.5 ml normal saline, and the incidence was lower in groups that had adjuvant added than in the control group (10%, 75%, respectively). But in this study, no adjuvants with bupivacaine were added. Therefore, the highest percentage of shivering was observed in patients who were administered 0.75% bupivacaine as compared to those who were given 0.5% of bupivacaine. Hence, we can conclude that intraoperative shivering in our study was dependent on the dose of bupivacaine rather than addition of adjuvants (1).

Another factor that contributes to intraoperative shivering is the indication for caesarean section. The parturient who had a previous caesarean section experienced the highest percentage of shivering in the previous study (27%), followed by fetal distress (12.5%). The findings were fairly comparable to those of this study, in which fetal distress was measured at 58.3% and history of previous caesarean sections at 11.0%, respectively (1).

In this conducted study, participants who had emergency cesarean section had higher incidence of intraoperative shivering as compared to elective surgeries. The former had 47.6% intraoperative shivering whereas 44.3% was recorded for elective surgeries. The results of previous studies also showed that shivering was higher in emergency surgeries (13).

The fundamental problem with shivering is that it causes to increase the oxygen intake and metabolic demand, results in higher oxygen levels and minute ventilation in most cases. By itself, metabolic demands boost the body's ability to transport oxygen to peripheral tissues, which leads to anaerobic metabolism and heart morbidity. Additionally, it interferes with the measurement of oxygen saturation, the ECG, and blood pressure while raising cardiac output, pulse rate, and intraocular pressure (1).

Conclusion

In this study the frequency of intraoperative shivering after caesarean section delivery under spinal anesthesia was comparable to many studies i.e., 43.1%. Body mass index, maternal comorbidities (hypertension, asthma, obesity), room temperature, premedication, duration of preoperative fasting, bupivacaine dose were associated with shivering in multivariate logistic regression having P-value less than 0.05. Type of fluid (crystalloid or Colloid), oxygen saturation during surgery, dose of oxytocin and incidence of nausea mainly contributed to intraoperative shivering with p value < 0.000. Maternal age, parity, type of C-section (emergency or elective), position of the patient during surgery (supine or supine-left tilt), Level of Spinal block, surgical duration and ASA status were not associated with onset of shivering p value > 0.05. The peak incidence of shivering in this conducted study was recorded less than five minutes after caesarean delivery.

Conflict of Interest

The authors declare no conflict of interest.

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Ethical Standards

The study protocol was ethically approved from the Advance Study Research Board (ASRB) of Rehman Medical Institute, Peshawar and Hayatabad Medical Complex, Peshawar, Pakistan.

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