



CHARACTERISTICS OF PATIENTS EXPERIENCING POST-SPINAL ANESTHESIA SHIVERING IN THE ELECTIVE OPERATING ROOM A

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ABSTRACT

Post-spinal anesthesia shivering can cause discomfort, increased metabolism, heightened surgical wound pain, and serious complications such as increased oxygen consumption, CO₂ production, hypoxemia, lactic acidosis, and cardiac arrhythmias. This condition may also interfere with the interpretation of vital sign monitoring. This study aims to describe the characteristics of patients experiencing shivering in the elective operating rooms of RSUD dr. Mohamad Soewandhie Surabaya. The study focuses on factors such as age, gender, body mass index (BMI), operating room temperature, and duration of surgery. This research employed a descriptive design and used consecutive sampling, involving 101 post-spinal anesthesia patients who experienced shivering in the elective operating rooms of RSUD dr. Mohamad Soewandhie Surabaya. Data were collected using an observation checklist and analyzed descriptively in the form of frequency distribution and percentages. The results showed that the majority of patients were in the late elderly age group (56–65 years) (51.5%), male (63.4%), and had a normal BMI (73.3%). All patients were exposed to operating room temperatures below 20°C (very cold), and almost all surgeries lasted between 1–2 hours (79.2%). Operating room temperature was the most dominant factor.

Keywords: factors influencing shivering; post-spinal anesthesia; shivering

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INTRODUCTION

Anesthesia is one of the initial procedures that must be prepared and administered to patients before surgery (Rahmawati, 2021). One of the most commonly used anesthetic techniques in surgical procedures is spinal anesthesia. Spinal anesthesia involves the administration of a local anesthetic into the cerebrospinal fluid (CSF) within the subarachnoid space to eliminate pain during surgery. The spread of the anesthetic agent is influenced by gravity, patient positioning, and cerebrospinal fluid pressure (Kasanah, 2019). The combination of spinal anesthesia and surgical intervention may impair the body's thermoregulatory mechanisms, resulting in a decrease in core body temperature. Consequently, the thresholds for vasoconstriction and shivering decrease by approximately 0.6°C, predisposing patients to hypothermia (Cahyawati et al., 2019).

Shivering causes considerable discomfort for patients and increases the metabolic rate by more than 40%, thereby intensifying postoperative wound pain due to muscle contractions around the surgical site. Furthermore, shivering significantly increases oxygen consumption (up to 40%), carbon dioxide production (hypercarbia), arterial hypoxemia, and lactic acidosis, while also increasing the risk of cardiac arrhythmias (Rahmawati, 2020). Post-anesthetic shivering is defined as an involuntary rhythmic contraction of one or more skeletal muscles that commonly occurs during the early recovery period following anesthesia. Besides causing patient discomfort, shivering may lead to arterial hypoxia, increased cardiac output, a higher risk of myocardial infarction, and interference with the interpretation of vital sign monitoring devices (Nugroho et al., 2016).

The incidence of shivering following spinal anesthesia at University Hospital of Lucus Augusti, Lugo, Spain, has been reported to range from 30% to 33% (Lopez, 2018). Similarly, the incidence of Post-Anesthetic Shivering (PAS) among postoperative patients at Yogyakarta Regional General Hospital ranges from 33% to 56.7% (Mashitoh et al., 2018). A study conducted at Sleman Regional General Hospital found that 25 of 44 respondents (56.8%) experienced shivering (Linasih et al., 2018). Another study involving 45 patients at Prof. Dr. Margono Soekarjo Regional General Hospital, Purwokerto, reported that 12 patients (26%) developed shivering after surgery (Prasetyo et al., 2017). In addition, the incidence of shivering following spinal anesthesia was reported to range between 37% and 57% in a study conducted at Karawang Regional General Hospital in 2014 (Irawan, 2018).

Based on data obtained from the Elective Operating Room of Dr. Mohamad Soewandhie Regional General Hospital, Surabaya, between August and October 2024, an average of 134 patients underwent surgery with spinal anesthesia each month. Interviews with nurse anesthetists revealed that among these patients, approximately 114 (85%) developed hypothermia. Hypothermia subsequently triggered shivering in approximately 67 patients (50%) each month among those undergoing surgery under spinal anesthesia during the same period.

Several factors have been associated with the occurrence of post-anesthetic shivering, including age, sex, body mass index (BMI), operating room temperature, and duration of surgery (Suwiknyo, 2023). Age is an important determinant because anatomical, physiological, and thermoregulatory functions differ across age groups. Age also influences body metabolism through hormonal mechanisms, thereby indirectly affecting body temperature regulation (Winarni, 2020).

Sex is another factor that may influence body temperature because progesterone affects thermoregulation. Men and women exhibit different patterns of body temperature regulation. Generally, women experience greater fluctuations in body temperature than men due to hormonal changes, particularly variations in progesterone levels. When progesterone levels decrease, body temperature may fall below the normal range (Winarni, 2020).

Individuals with a low body mass index tend to lose body heat more rapidly, increasing their susceptibility to shivering (Firdaus et al., 2022). Metabolic rate varies among individuals and is influenced by body size, including height and weight, which are represented by body mass index. BMI is therefore an important factor affecting metabolism and thermoregulation (Kozier & Erb, 2017). When exposed to an environment colder than their body temperature, humans continuously generate internal heat to maintain thermal balance. Heat production depends on the oxidation of metabolic fuels derived from food intake and stored fat (Mamola, 2020). Consequently, individuals with greater body mass generally possess more adipose tissue, enabling better preservation of body heat (Smeltzer & Bare, 2017).

Exposure to low operating room temperatures is another major contributor to hypothermia and subsequent shivering. Heat loss occurs through thermal conduction between the patient's skin surface and the surrounding environment (Nugraheni, 2020). Sari (2020) also reported that low ambient temperatures in the operating room contribute to hypothermia through the same mechanism. Operating room temperatures are typically maintained between 20°C and 24°C to minimize bacterial growth (Nugraheni, 2020).

The duration of surgery is also associated with the occurrence of post-anesthetic shivering (Prasetyo et al., 2023). The combined effects of spinal anesthesia and prolonged surgical procedures impair thermoregulatory function, resulting in decreased core body temperature and the development of shivering (Romansyah et al., 2022). The risk of shivering increases with longer surgical duration because prolonged exposure to a cold environment and extended anesthetic effects contribute to

greater heat loss (Misra et al., 2023). This condition is particularly common in moderate to major surgical procedures lasting more than one hour. Based on these findings, the present study aimed to describe the characteristics of patients who experienced shivering following spinal anesthesia in the Elective Operating Room. The findings are expected to provide baseline information and serve as a reference for future and ongoing research related to post-spinal anesthesia shivering.

METHOD

This study employed a descriptive research design. The objective was to describe the characteristics of patients who experienced shivering following spinal anesthesia in the Elective Operating Room. The study focused on several patient characteristics, including age, sex, body mass index (BMI), operating room temperature, type of surgery, and other factors associated with post-spinal anesthesia shivering. The study population consisted of all patients who experienced shivering after spinal anesthesia in the Elective Operating Room during the study period. A total sampling technique was employed, whereby all eligible patients who met the inclusion criteria were included in the study. Consequently, the final sample comprised 101 patients.

Data were collected using an observation sheet completed by the researchers based on direct observation and review of patients' medical records. Information regarding demographic characteristics, including age, sex, body mass index (BMI), type of surgery, operating room temperature, and the occurrence of post-spinal anesthesia shivering, was recorded immediately after surgery in the post-anesthesia care unit (PACU). The collected data were subsequently checked for completeness and entered into a database for analysis. Descriptive statistics were used to summarize the characteristics of the respondents. Categorical variables were presented as frequencies and percentages. The interpretation of percentage distributions followed the classification proposed by Kartika (2017): 100% = all respondents; 76%–99% = almost all; 51%–75% = the majority; 50% = half; 26%–49% = nearly half; 1%–25% = a minority; and 0% = none.

RESULT

General Data

Respondent characteristics based on type of operation

Table 1.

Frequency distribution of respondents based on the type of surgery in the Elective Operating Room

Indicator	f	%
Urology	42	41.6
General Surgery	30	29.7
Obgyn (Obstetrics)	16	15.8
Orthopedics	13	12.9

Based on table 1, it shows that of the 101 respondents, almost half of them had urological operations.

Respondent characteristics based on diagnosis in the operating room

Table 2.

Frequency distribution of respondents based on diagnosis in the Elective Operating Room

Diagnosis	f	%
Benign Prostatic Hyperplasia (BPH)	22	21.8
Ureteral Stones	18	17.8
Hernia (Scrotal & Incisional)	14	13.9
Renal Stone	12	11.9
Hemorrhoids	10	9.9
Anal Fistula	6	5.9
Bartholin's cyst	5	5
Uterine Prolapse	4	4
Cellulitis Pedis	4	4
Urethral stricture	3	3

Based on table 2 shows a small proportion of Benign Prostatic Hyperplasia (BPH) diagnoses.

Table 3.

Frequency distribution of respondents based on degrees *Shivering* in the Elective Operating Room

Shivering Degree	f	%
Grade 1	44	43.6
2nd degree	35	34.7
3rd degree	22	21.8
Grade 4	0	0

Based on table 3, it shows that of the 101 respondents, almost half of the patients experienced grade 1 shivering.

Special Data

Respondent Characteristics Based on Age

Table 4.

Frequency distribution of respondents based on age in the Elective Operating Room

Age	f	%
Late Adulthood (36–45 years)	18	17.8
Early Adulthood (26–35 years)	14	13.9
Late Elderly (56–65 years)	52	51.5
Early Old Age (46–55 years)	13	12.9
Late Adolescence (17–25 years)	4	4

Based on table 4, it shows that of the 101 respondents, the majority were in the late elderly category (56-65 years).

Respondent Characteristics Based on Gender

Table 5.

Frequency distribution of respondents based on gender in the Elective Operating Room

Gender	f	%
Man	64	63.4
Woman	37	36.6

Based on table 5, it shows that of the 101 respondents, the majority were male.

Respondent Characteristics Based on Gender

Table 6.

Frequency distribution of respondents based on body mass index (BMI) in the Elective Operating Room

Body Mass Index (BMI)	f	%
<18.5 kg/m ²	2	2.0
18.5–25.0 kg/m ²	74	73.3
>25.0 kg/m ²	25	24.8

Based on table 6, it shows that of the 101 respondents, the majority of BMI is in the normal category (18.5-25.0).

Respondent characteristics based on operating room temperature

Table 7.

Frequency distribution of respondents based on operating room temperature in the Elective Operating Room

Operating Room Temperature	f	%
15°C	4	4.0
16°C	22	21.8
17°C	33	32.7
18°C	39	38.6
19°C	3	3.0

Based on table 7, it shows that of the 101 respondents, all were in the temperature category < 20°C (very cold category).

Respondent characteristics based on length of operation

Table 8.

Frequency distribution of respondents based on the length of operation in the Elective Operating Room

Operation Time	f	%
< 1 hour	21	20.8
1–2 hours	80	79.2

Based on table 5.8, it shows that of the 101 respondents, almost all of them had an operation lasting between 1-2 hours.

DISCUSSION

Characteristics Based on Age

Table 1 shows that, among the 101 respondents, the majority were in the late elderly age group (56–65 years), comprising 52 respondents (51.5%). Aging is associated with progressive impairment of thermoregulatory mechanisms, including reduced vasoconstrictive responses, diminished metabolic heat production, and decreased sensitivity of peripheral thermoreceptors, making older adults more vulnerable to perioperative hypothermia and shivering (American Society of Anesthesiologists, 2023; Misra et al., 2023). Older patients also exhibit slower physiological adaptation to temperature changes during surgery, increasing the likelihood of postoperative shivering.

In the present study, a minority of respondents (21.8%) were diagnosed with benign prostatic hyperplasia (BPH), while nearly half (41.6%) underwent urological surgery. Since BPH predominantly affects older men, these findings suggest that respondents with BPH who underwent urological procedures were mainly in the late elderly age group (56–65 years), making them more susceptible to impaired thermoregulation and post-spinal anesthesia shivering than younger patients. Similar findings have been reported in recent perioperative studies showing that advanced age remains an independent predictor of postoperative hypothermia and shivering due to age-related physiological decline (Yi et al., 2022).

Characteristics Based on Sex

Table 2 indicates that the majority of respondents were male, accounting for 64 individuals (63.4%). Although previous studies have suggested that women generally have lower thermoregulatory tolerance because of differences in body composition and hormonal regulation, recent evidence indicates that sex alone is not a consistent predictor of postoperative shivering when other clinical factors are considered (Yi et al., 2022; Misra et al., 2023). Instead, the interaction between age, anesthetic technique, and perioperative temperature management appears to play a more substantial role.

Although males constituted the majority of participants in the present study, previous evidence suggests that females are inherently more vulnerable to thermoregulatory disturbances and postoperative shivering. This discrepancy may be explained by the age distribution of the sample, as most male respondents were in the late elderly age group, which itself is a well-established risk factor for impaired thermoregulation. Therefore, advanced age may have had a greater influence on the occurrence of shivering than sex alone. These findings emphasize that postoperative shivering is multifactorial and should be evaluated using several patient-related and procedural variables rather than sex alone.

Characteristics Based on Body Mass Index (BMI)

Table 3 demonstrates that most respondents had a normal Body Mass Index (BMI; 18.5–25.0 kg/m²), accounting for 74 participants (73.3%). Physiologically, adipose tissue functions as thermal insulation that reduces heat loss from the body. Consequently, individuals with lower BMI are generally considered more susceptible to perioperative hypothermia than those with higher BMI. Recent evidence, however, suggests that BMI has only a modest influence on postoperative

shivering because perioperative warming strategies and anesthetic management also contribute substantially to temperature regulation (Misra et al., 2023).

Interestingly, despite this physiological theory, most respondents who experienced shivering had a normal BMI. This finding suggests that BMI alone may not adequately predict the occurrence of postoperative shivering. Individual variability in thermoregulatory capacity, together with other contributing factors such as age, duration of surgery, operating room temperature, and anesthetic management, may have a greater influence on shivering than BMI alone.

Characteristics Based on Operating Room Temperature

Table 4 shows that all respondents (100%) underwent surgery in an operating room with an ambient temperature below 20°C, classified as a very cold environment. Low ambient temperatures increase conductive, convective, and radiant heat loss from the patient's body, thereby predisposing patients to perioperative hypothermia and postoperative shivering (National Institute for Health and Care Excellence, 2022). Effective perioperative temperature management is therefore recommended to minimize heat loss during surgery.

The finding that every patient was exposed to an operating room temperature below 20°C reinforces previous evidence that a cold surgical environment is an important risk factor for post-spinal anesthesia shivering. However, the researchers propose that although operating room temperatures were consistently very low, the risk of shivering may be lower in procedures lasting less than one hour because cumulative heat loss is reduced during shorter surgical procedures.

Characteristics Based on Duration of Surgery

Table 5 indicates that the majority of respondents (79.2%) underwent surgical procedures lasting between one and two hours (80 of 101 respondents). Previous studies have consistently demonstrated that prolonged surgical duration increases the likelihood of postoperative shivering due to extended exposure to cold environments and the cumulative effects of spinal anesthesia (Misra et al., 2023). Prolonged anesthesia reduces thermoregulatory vasoconstriction, allowing continued redistribution of core body heat to peripheral tissues.

Prasetyo et al. (2023) reported that spinal anesthesia impairs the body's thermoregulatory mechanisms, leading to a reduction in core body temperature. Similarly, Romansyah et al. (2022) stated that longer operative times increase heat loss and consequently elevate the risk of postoperative shivering. Based on these findings, the researchers suggest that prolonged exposure to a very cold operating room environment may disrupt normal thermoregulation, thereby increasing the likelihood of post-spinal anesthesia shivering. Therefore, maintaining normothermia throughout the perioperative period through active warming interventions and continuous temperature monitoring remains an important strategy for reducing postoperative shivering.

CONCLUSION

This study found that patients who experienced shivering following spinal anesthesia in the elective operating room of Dr. Mohamad Soewandhie Regional General Hospital, Surabaya, were predominantly late elderly adults (56–65 years), male, and had a normal body mass index (BMI). Most surgical procedures lasted between 1 and 2 hours, and all patients underwent surgery in operating rooms with temperatures below 20°C. These findings provide an overview of the characteristics of patients experiencing post-spinal anesthesia shivering and may serve as a reference for future studies and the development of preventive strategies in perioperative nursing practice.

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