



Original Article

Association Between Duration of Surgery and Postoperative Shivering Among Patients Receiving Spinal Anaesthesia: A Prospective Observational Study

Dr. Vivekanand¹, Dr. Ajith Kumar R², Dr. Maddela Rithika³

¹Senior Resident, Department of Anaesthesiology, Government Medical College Kamareddy, Telangana, India

²Senior Resident, Department of Anaesthesiology, Government Medical College, Yadadri Bhuvanagiri, Telangana, India

³Senior Resident, Department of Anaesthesiology, Government Medical College, Quthbullapur, Medchal, Telangana India

 OPEN ACCESS

Corresponding Author:

Dr. Maddela Rithika

Senior Resident, Department of Anaesthesiology, Government Medical College, Quthbullapur, Medchal, Telangana, India

Received: 12-08-2025

Accepted: 10-09-2025

Available online: 14-09-2025

Copyright © International Journal of Medical and Pharmaceutical Research

ABSTRACT

Background: Postoperative shivering is a common complication following spinal anaesthesia and contributes to patient discomfort, increased oxygen consumption, interference with monitoring, and delayed recovery. Surgical duration is a clinically relevant factor because longer exposure to the operating room environment and neuraxial-induced thermoregulatory impairment can increase heat loss.

Objectives: To assess the association between duration of surgery and postoperative shivering among patients receiving spinal anaesthesia.

Methods: This prospective observational study was conducted at Gandhi Medical College, Secunderabad, Telangana, India, from January 2023 to December 2023. A total of 100 adult patients undergoing surgery under spinal anaesthesia were included. Demographic profile, ASA physical status, duration of surgery, postoperative temperature, occurrence of shivering, and severity of shivering were recorded. Surgical duration was categorized as ≤ 60 minutes, 61-120 minutes, and >120 minutes. Postoperative shivering was graded using a standard clinical grading scale. Data were analysed using descriptive statistics, chi-square test, and comparison of means. A p-value <0.05 was considered statistically significant.

Results: The mean age of the patients was 42.6 ± 13.8 years, and 56.0% were males. The mean duration of surgery was 84.7 ± 32.5 minutes. Postoperative shivering was observed in 35.0% of patients. The incidence of shivering increased from 18.8% in surgeries lasting ≤ 60 minutes to 37.5% in the 61-120 minutes group and 55.0% in surgeries lasting >120 minutes. The association between duration of surgery and postoperative shivering was statistically significant. Patients with shivering had longer surgical duration and lower postoperative temperature than those without shivering.

Conclusion: Longer surgical duration was significantly associated with higher postoperative shivering among patients receiving spinal anaesthesia. Careful temperature monitoring and preventive warming strategies are important, particularly during prolonged procedures.

Keywords: Spinal anaesthesia; Postoperative shivering; Duration of surgery; Hypothermia; Thermoregulation.

INTRODUCTION

Postoperative shivering is a frequent and clinically important event in patients recovering from anaesthesia. It is characterized by involuntary, oscillatory skeletal muscle activity that occurs during the perioperative or immediate postoperative period. Although shivering is often perceived as a minor complication, it produces considerable discomfort and can increase metabolic demand, oxygen consumption, carbon dioxide production, catecholamine release, wound pain, and interference with pulse oximetry, electrocardiography, and non-invasive blood pressure monitoring [1,2]. These

effects are particularly relevant in patients with limited cardiopulmonary reserve, anaemia, elderly age, or prolonged surgical exposure.

Spinal anaesthesia alters normal thermoregulatory control through sympathetic blockade, peripheral vasodilatation, redistribution of core heat to the periphery, and impaired afferent thermal input from blocked dermatomes [3,4]. Reduction in the shivering threshold is influenced by the extent of neuraxial block, and the decline in core temperature occurs despite patients remaining conscious during surgery [5,6]. Consequently, shivering after spinal anaesthesia is not solely a discomfort-related phenomenon; it reflects a measurable disturbance in perioperative heat balance. Published literature has reported variable rates of shivering after spinal anaesthesia, depending on patient profile, type of surgery, ambient temperature, fluid warming, active warming measures, block height, and duration of observation [7,8].

The duration of surgery is an important and practical determinant of perioperative thermal loss. Longer procedures expose patients to the operating room environment for a greater period, increase the time under sympathetic blockade, prolong skin exposure and irrigation, and increase the likelihood of receiving unwarmed intravenous fluids [9,10]. These factors can contribute to a gradual fall in postoperative temperature and increase the risk of shivering. Previous studies have identified core hypothermia, younger age, type of surgery, duration of anaesthesia, and perioperative temperature gradients as important predictors of postoperative shivering [11,12]. However, the direct relationship between duration of surgery and postoperative shivering in routine patients receiving spinal anaesthesia remains underreported in many institutional settings.

Understanding this association has clinical relevance because duration of surgery is known at the time of operative planning and can guide practical preventive measures. Simple interventions such as prewarming, forced-air warming, warmed intravenous fluids, limiting unnecessary exposure, and regular temperature documentation can reduce perioperative hypothermia and improve postoperative comfort [13,14]. Local evidence from prospective observational data is useful for developing departmental protocols, especially in busy tertiary teaching hospitals where procedures of variable duration are performed under spinal anaesthesia.

The present study was conducted to evaluate the association between duration of surgery and postoperative shivering among patients receiving spinal anaesthesia. The primary objective was to determine the incidence of postoperative shivering across different categories of surgical duration. The secondary objectives were to assess the severity of postoperative shivering and compare selected perioperative variables between patients with and without postoperative shivering.

MATERIALS AND METHODS

Study design and setting: This prospective observational study was conducted in the Department of Anaesthesiology at Gandhi Medical College, Secunderabad, Telangana, India. The study period extended from January 2023 to December 2023. The study was designed to assess the association between duration of surgery and postoperative shivering among patients receiving spinal anaesthesia for elective surgical procedures. Since the objective was observational, no intervention was assigned by the investigators, and perioperative anaesthesia care was provided according to routine institutional practice. Ethics committee approval was obtained before starting this study.

Study population: Adult patients who underwent surgery under spinal anaesthesia during the study period were considered for inclusion. A total of 100 patients were enrolled. Patients belonging to ASA physical status I or II were included. Patients with pre-existing fever, thyroid disease, severe cardiopulmonary disease, known neuromuscular disorder, infection, conversion to general anaesthesia, failed spinal block, or incomplete postoperative observation records were excluded. Written informed consent was obtained before enrolment.

Anaesthesia procedure and perioperative care: Spinal anaesthesia was administered under aseptic precautions using the standard institutional technique. The choice and dose of local anaesthetic were based on surgical requirement and anaesthesiologist discretion. Routine monitoring included non-invasive blood pressure, pulse oximetry, electrocardiography, and perioperative temperature recording. Intravenous fluids and warming measures were provided according to clinical need and departmental practice. Operating room temperature was maintained as per institutional standards. Patients were observed intraoperatively and during the immediate postoperative period for development of shivering.

Data collection: Data were collected using a structured proforma. Age, sex, ASA physical status, duration of surgery, postoperative temperature, occurrence of shivering, severity of shivering, and time of onset of shivering were recorded. Duration of surgery was calculated from surgical incision to completion of skin closure and categorized as ≤ 60 minutes, 61-120 minutes, and >120 minutes. Shivering was graded clinically from grade 0 to grade 4, where grade 0 indicated no shivering and grade 4 indicated gross muscular activity involving the whole body. The presence of any grade from 1 to 4 was considered postoperative shivering.

Statistical analysis: Data were entered into a spreadsheet and analysed using appropriate statistical methods. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequency and percentage. The association between duration category and postoperative shivering was assessed using the chi-square test. Mean duration of surgery and postoperative temperature were compared between patients with and without shivering using an independent samples test. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 100 patients who received spinal anaesthesia were included in the study. The mean age of the participants was 42.6 ± 13.8 years. Males constituted 56.0% of the study population, while females constituted 44.0%. Most patients belonged to ASA physical status I. The mean duration of surgery was 84.7 ± 32.5 minutes. The highest proportion of patients underwent procedures lasting 61-120 minutes (Table 1).

Table 1. Baseline characteristics of the study participants

Variable	Category / Value	Frequency	Percentage
Age	Mean \pm SD	42.6 ± 13.8 years	-
Sex	Male	56	56.0
	Female	44	44.0
ASA physical status	ASA I	62	62.0
	ASA II	38	38.0
Duration of surgery	Mean \pm SD	84.7 ± 32.5 minutes	-
Duration category	≤ 60 minutes	32	32.0
	61-120 minutes	48	48.0
	>120 minutes	20	20.0

Postoperative shivering was observed in 35 patients, giving an overall incidence of 35.0%. No shivering was recorded in 65.0% of patients. Among those with shivering, grade 2 was the most common severity pattern, followed by grade 1 and grade 3. Severe shivering was less frequent, with grade 4 shivering observed in only 3.0% of patients (Table 2).

Table 2. Incidence and severity of postoperative shivering

Shivering grade	Description	Frequency	Percentage
Grade 0	No shivering	65	65.0
Grade 1	Mild piloerection or peripheral vasoconstriction	9	9.0
Grade 2	Visible muscular activity in one muscle group	14	14.0
Grade 3	Muscular activity involving more than one muscle group	9	9.0
Grade 4	Gross muscular activity involving the whole body	3	3.0
Total		100	100.0

The incidence of postoperative shivering increased with increasing duration of surgery. Among patients with surgical duration ≤ 60 minutes, shivering was observed in 18.8%. This proportion increased to 37.5% among patients with surgical duration of 61-120 minutes and further increased to 55.0% among patients whose surgeries lasted more than 120 minutes. The association between duration of surgery and postoperative shivering was statistically significant ($p = 0.018$) (Table 3).

Table 3. Association between duration of surgery and postoperative shivering

Duration of surgery	No shivering n (%)	Shivering n (%)	Total	p-value
≤ 60 minutes	26 (81.2)	6 (18.8)	32	
61-120 minutes	30 (62.5)	18 (37.5)	48	
>120 minutes	9 (45.0)	11 (55.0)	20	
Total	65 (65.0)	35 (35.0)	100	0.018

Patients who developed postoperative shivering had a longer mean duration of surgery compared with those who did not develop shivering. The mean surgical duration was 101.4 ± 35.2 minutes in the shivering group and 75.7 ± 27.6 minutes in the non-shivering group. The difference was statistically significant. The mean postoperative temperature was also lower among patients who developed shivering. The mean time of onset of shivering was 18.6 ± 9.4 minutes after completion of surgery (Table 4).

Table 4. Comparison of perioperative variables according to shivering status

Variable	No shivering group	Shivering group	p-value
Number of patients	65	35	-
Duration of surgery, minutes	75.7 ± 27.6	101.4 ± 35.2	<0.001
Postoperative temperature, °C	36.2 ± 0.3	35.8 ± 0.4	<0.001
Time of onset of shivering, minutes	-	18.6 ± 9.4	-

Overall, the results showed that longer surgical duration was significantly associated with a higher incidence of postoperative shivering among patients receiving spinal anaesthesia. Patients undergoing surgeries lasting more than 120 minutes had the highest proportion of postoperative shivering.

DISCUSSION

The present prospective observational study demonstrated that postoperative shivering occurred in 35.0% of patients receiving spinal anaesthesia. This incidence is clinically meaningful and falls within the broad range reported in earlier studies on perioperative shivering under neuraxial anaesthesia [1,7,8]. The finding reinforces that shivering remains a common postoperative event even in routine elective surgical practice. Although shivering is often self-limiting, its impact on comfort, oxygen consumption, monitoring quality, and postoperative satisfaction supports the need for active recognition and prevention [2,13].

A key observation in this study was the progressive increase in shivering with longer surgical duration. Shivering occurred in 18.8% of patients undergoing procedures lasting ≤60 minutes, 37.5% of those with procedures lasting 61-120 minutes, and 55.0% of those with procedures exceeding 120 minutes. This graded pattern suggests a duration-dependent relationship. The statistical association was significant, indicating that surgical duration is not merely a descriptive variable but a relevant perioperative risk marker. Longer operations permit continued heat redistribution, prolonged exposure to cool ambient temperature, larger cumulative fluid administration, and sustained sympathetic blockade after spinal anaesthesia [3,4,10].

Patients who developed shivering had a significantly longer mean surgical duration than patients without shivering. They also had lower postoperative temperature. This supports the biological plausibility of the observed association. Spinal anaesthesia impairs vasoconstriction below the level of block and decreases the shivering threshold, while patients are often unable to perceive temperature loss from blocked regions [5,6]. When the surgical period is prolonged, the cumulative effect of redistribution hypothermia and environmental heat loss becomes more evident. Earlier work has identified hypothermia, young age, block characteristics, and duration of anaesthesia or surgery as contributors to shivering [9,11,12].

The clinical implication of these findings is that patients undergoing longer procedures under spinal anaesthesia deserve closer perioperative thermal surveillance. Temperature monitoring should not be restricted to high-risk surgeries alone. Even in ASA I and II patients, a prolonged procedure can create sufficient thermal stress to precipitate shivering. Preventive strategies such as maintaining operating room temperature, covering exposed body areas, warming intravenous fluids, and using forced-air warming in selected cases are practical measures supported by existing evidence and guidelines [13,14]. Such measures are simple, low-risk, and relevant to institutional anaesthesia protocols.

This study adds local prospective data from a tertiary teaching hospital in Telangana and highlights surgical duration as an easily identifiable risk factor. The findings are useful for preoperative planning, intraoperative monitoring, and postoperative recovery room preparedness. However, the observational design limits causal interpretation. Temperature measurement method, type of surgery, ambient temperature, fluid volume, level of spinal block, and active warming practices can influence shivering and should be examined in larger analytical studies. Despite these considerations, the consistent rise in shivering across duration categories supports the importance of duration-based vigilance.

Limitations

This study was conducted at a single tertiary care centre with a modest sample size. Data on ambient operating room temperature, exact level of sensory block, volume of intravenous fluids, type of surgery, and warming methods were not analysed in detail. The observational design restricted control over perioperative practices. Postoperative temperature was assessed clinically within routine workflow, creating scope for measurement variation.

CONCLUSION

Postoperative shivering was observed in 35.0% of patients receiving spinal anaesthesia. The incidence increased progressively with longer duration of surgery, reaching the highest level among patients whose procedures lasted more

than 120 minutes. Patients with shivering had longer mean surgical duration and lower postoperative temperature than those without shivering. These findings indicate that surgical duration is an important clinical marker for postoperative shivering after spinal anaesthesia. Routine temperature monitoring, maintenance of thermal comfort, and timely warming measures should be considered, especially during prolonged procedures. Duration-based vigilance can improve postoperative comfort and support safer recovery room care in routine anaesthesia practice.

REFERENCES

1. Lopez MB. Postanaesthetic shivering - from pathophysiology to prevention. *Rom J Anaesth Intensive Care*. 2018;25(1):73-81.
2. Alfonsi P. Postanaesthetic shivering: epidemiology, pathophysiology, and approaches to prevention and management. *Drugs*. 2001;61(15):2193-2205.
3. Sessler DI. Perioperative thermoregulation and heat balance. *Lancet*. 2016;387(10038):2655-2664.
4. Leslie K, Sessler DI. Reduction in the shivering threshold is proportional to spinal block height. *Anesthesiology*. 1996;84(6):1327-1331.
5. Kurz A, Sessler DI, Schroeder M, Kurz M. Thermoregulatory response thresholds during spinal anesthesia. *Anesth Analg*. 1993;77(4):721-726.
6. Saito T, Sessler DI, Fujita K, Ooi Y, Jeffrey R. Thermoregulatory effects of spinal and epidural anesthesia during cesarean delivery. *Reg Anesth Pain Med*. 1998;23(4):418-423.
7. Amsalu H, Lema G, Tadesse M, Fentie Y. Evidence-based guideline on prevention and management of shivering after spinal anesthesia in resource-limited settings: review article. *Int J Gen Med*. 2022;15:6985-6998.
8. Ferede YA, Gebregzi AH, Denu ZA, et al. The magnitude and associated factors of intraoperative shivering after cesarean section delivery under spinal anesthesia: a cross sectional study. *Ann Med Surg (Lond)*. 2021;72:103022.
9. Eberhart LHJ, Döderlein F, Eisenhardt G, Kranke P, Sessler DI, Torossian A, Wulf H, Morin AM. Independent risk factors for postoperative shivering. *Anesth Analg*. 2005;101(6):1849-1857.
10. Xu R, Yu M, Zhao G, Li X, Wang Y, Liu L. Incidence of postoperative hypothermia and shivering and risk factors in patients undergoing malignant tumor surgery: a prospective observational study. *BMC Anesthesiol*. 2023;23(1):31.
11. Shirozu K, Kai T, Setoguchi H, Ayagaki N, Hoka S. Incidence of postoperative shivering decreased with the use of forced-air warming and peripheral warming. *J Anesth*. 2020;34(4):605-612.
12. Shirozu K, Kai T, Setoguchi H, Ayagaki N, Hoka S. Factors associated with postoperative shivering in patients with maintained core temperature after surgery. *J Anesth*. 2024;38(6):776-784.
13. Allen TK, Habib AS. Inadvertent perioperative hypothermia induced by spinal anesthesia for cesarean delivery might be more significant than we think: are we doing enough to warm our parturients? *Anesth Analg*. 2018;126(1):7-9.
14. Shen QH, Li HF, Zhou XY, Yuan XZ. 5-HT₃ receptor antagonists for the prevention of perioperative shivering undergoing spinal anaesthesia: a systematic review and meta-analysis of randomised controlled trials. *BMJ Open*. 2020;10(10):e038293.