HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2021.70037
Haydarpasa Numune Med J 2021;61(4):417–421

hnhtipdergisi.com

ORIGINAL ARTICLE

Incidence of Perioperative Hypothermia in Geriatric Patients Undergoing Elective Surgery

Şule Batçık, Leyla Kazancıoğlu

Department of Anesthesiology and Reanimation, Recep Tayyip Erdoğan University Faculty of Medicine, Rize, Turkey

Abstract

Introduction: Perioperative hypothermia (POH) emerges as an important problem in increasing the morbidity and mortality rates of geriatric patients. The purpose of this study was to determine the incidence of POH in geriatric patients undergoing elective surgery. In addition, to determine the risk factors associated with POH in geriatric patients, to contribute to the improvement of temperature monitoring awareness and body temperatures.

Methods: Patients over 65 years of age who would undergo elective surgery under sedoanalgesia, general and regional anesthesia were included in the study. Demographic and operative data of the patients, body temperatures at the time of entering the waiting room and exiting the waiting room in the pre-operative period, at the 0th min (min), 60th min, 120th min, 180th min, and 240th min in the intraoperative period and in the post-operative period, and body temperatures at the time of entry and exit from the recovery unit were measured from the tympanic membrane and recorded. Body temperatures below 36°C were accepted as hypothermia.

Results: A total of 178 patients, including 75 females (42.1%) and 103 males (57.8%), were included in the study. The mean age of the patients was 73±7.44 years. While the pre-operative mean body temperature of the patients was 36.8±0.46°C, the mean body temperature at the entrance and exit of the postoperative recovery unit was 35.61±0.89°C and 36.11±0.63°C, respectively. In the intraoperative period, the mean value of body temperature at the 0th min was found to be higher than the 60th, 120th, and 180th min, which was statistically significant ($p<0.01$). A statistically significant difference was found in all time frame comparisons of prolonged operation time and decrease in body temperature ($p<0.01$).

Discussion and Conclusion: In our study, POH emerges as an important problem in geriatric patients. We suggest that routine monitoring of body temperature and warming of patients are necessary to prevent hypothermia in geriatric patients. Especially in operations that are planned to take a long time; improvements should be implemented quickly to avoid hypothermia.

Keywords: Body temperature; elective surgery; geriatrics hypothermia; incidence.

As a country's population ages, the demand for surgical services increases. While the ratio of the geriatric population in the total population in our country was 8.2% in 2015, it increased by 22.5% in the past 5 years and reached 9.5% in 2020[1]. Geriatric patients need more careful care in the perioperative period than younger patients due to their low cardiopulmonary reserves, comorbidities, and multiple drug use. Therefore, health-care costs are also higher. Maintaining a high quality of anesthesia care to reduce perioperative complications in elderly surgical patients will provide great benefits for patients and society. Therefore, anesthetists have to review the perioperative problems and take precautions for the care of geriatric patients.

Perioperative hypothermia (POH) emerges as an important

Correspondence (İletişim): Şule Batçık, M.D. Recep Tayyip Erdogan Universitesi Tip Fakultesi, Anesteziyoloji ve Reanimasyon Anabilim Dali, Rize, Turkey
Phone (Telefon): +90 505 676 55 09 **E-mail (E-posta):** drsulebatcik@gmail.com
Submitted Date (Başvuru Tarihi): 10.10.2021 **Accepted Date (Kabul Tarihi):** 20.10.2021
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problem in increasing the morbidity and mortality rates of geriatric patients. For this reason, many studies have been conducted to investigate the effects of different heating methods under different anesthesia and surgical applications of POH in geriatric patients[2-5].

The primary aim of this study was to determine the incidence of POH in geriatric patients undergoing elective surgery. The secondary aim is to determine the risk factors associated with POH in geriatric patients, to contribute to the improvement of temperature monitoring awareness and body temperatures.

Materials and Methods

This study was carried out with patients whose informed consent was obtained between May 15, 2018, and October 15, 2018, following the approval of the Recep Tayyip Erdoğan University Non-Interventional Clinical Research Ethics Committee (2018/91). Patients over 65 years of age with an operation time of at least 60 min (min), male or female gender, having physical status of the American Society of Anesthesiologists (ASA) I–IV, undergoing elective surgery under sedoanalgesia, general and regional anesthesia, were included in the study. Patients with cerebrovascular disease, cerebral trauma, high body temperature caused by central nervous system disease including those induced by epilepsy, hypothyroidism/hyperthyroidism, thermoregulation abnormalities including neuroleptic malignant syndrome, infectious fever, conditions that may cause inaccuracy in measurement such as ear infection, and routine temperature patients who underwent open heart surgery and were monitored were excluded from the study.

In the perioperative period, electrocardiogram, non-invasive blood pressure, end-tidal carbon dioxide pressure ($EtCO_2$), and peripheral oxygen saturation (SpO_2) monitoring with pulse oximetry were performed. Body temperature measurements were made from the tympanic membrane using a digital thermometer (BRAUN, ThermoScan 5 Ear, Thermometer). Body temperature below 36°C was considered as hypothermia[6].

In the pre-operative period, demographic data such as age, gender, body mass index, ASA scores, body temperatures at the time of entering the waiting room and exiting the waiting room, length of stay in the waiting room, and waiting room temperature were recorded.

In the intraoperative period, operating room temperature, operation time, total intravenous fluid given, irrigation fluid use and amount, if any, surgical classification of the surgery performed by the patients, laparoscopic applications, type of anesthesia applied (sedoanalgesia, general anesthesia, and regional anesthesia), and whether or not heating was applied to the patients were recorded. During this period, the patients' heart rate, mean blood pressure, $EtCO_2$, SpO_2 values, and mean body temperature were recorded as 0th min, 60th min, 120th min, 180th min, and 240th min.

In the post-operative period, the room temperature of the recovery unit, the length of stay of the patients in the recovery unit, the time it took to achieve an Aldrete score of 10, the number of patients with and without shivering, and body temperatures at the time of entering the recovery unit and at the time exiting from the recovery unit were recorded.

Statistical Analysis

Study data were evaluated with the help of descriptive statistical methods (mean, standard deviation, median, frequency, minimum, and maximum) and the distribution of the data was evaluated with the Kolmogorov–Smirnov test. The Friedman test was used for comparisons of quantitative data over three periods or more that did not show normal distribution. Wilcoxon test was used for comparison of the quantitative data between two periods that did not show normal distribution. In all examinations, $p<0.05$ level was evaluated as significant.

Results

A total of 197 patients were included in the study. Nineteen patients were excluded from the study due to missing data at the stage of collection of records. The study was continued with 178 patients, 75 women (42.1%) and 103 men (57.8%). The mean age of the patients was 73±7.44 years. Demographic data and ASA physical status of the patients are shown in Table 1. No statistically significant difference was found between the perioperative heart rate, mean blood pressure, $EtCO_2$, and SpO_2 values of the patients in the measured time periods ($p>0.05$). While the pre-operative mean body temperature of the patients was 36.8±0.46°C, the mean body temperature at the entrance and exit of the post-operative recovery unit was 35.61±0.89°C and

Table 1. Demographic data

Age (years)	73±7.44
Gender (female), n (%)	75 (42.1%)
BMI (kg/m^2)	26.84±4.67
ASA (II/III/IV)	99/71/8

BMI: Body mass index; ASA: American Society of Anesthesiologists.

36.11±0.63°C, respectively (Table 2). In the intraoperative period, the mean value of body temperature at the 0th min was found to be higher than the 60th, 120th, and 180th min, which was statistically significant (p<0.01). A statistically significant difference was found in all time frame comparisons of prolonged operation time and decrease in body temperature (p<0.01) (Table 3).

Table 2. Operative period data (n=178)

Pre-operative period	
Body temperature (arrival) (°C)	36.8±0.46
Waiting room temperature (°C)	22.48±0.84
Waiting time in the waiting room (minute)	20.46±8,68
Body temperature (exit) (°C)	36.7±0.4
Intraoperative period	
Operating room temperature (°C)	20.84±2.05
Surgery duration (minute)	115.87±57.58
Total amount of intravenous fluid given (mL)	1524.15±782.89
Number of patients given irrigation fluid (used), n (%)	42 (23.60)
Total amount of irrigation fluid given (mL)	18876.19±8657.714
Applied anesthesia method	
Sedoanalgesia, n (%)	8 (4.5)
General anesthesia, n (%)	109 (61.2)
Regional anesthesia, n (%)	61 (34.2)
Surgery grade	
Class I, n (%)	8 (4.5)
Class II, n (%)	70 (39.3)
Class III, n (%)	85 (47.8)
Class IV, n (%)	15 (8.4)
Laparoscopic surgery (applied), n (%)	44 (24.7)
Number of patients applying active heating with air blowing, n (%)	36 (20.2)
Post-operative period	
Time to 10 for Aldrete score (minute)	23.15±7.3
Number of patients with shivering, n (%)	47 (26.6)
Recovery room temperature (°C)	23.49±0.77
Length of stay in the recovery room (minute)	30.69±13.60
Body temperature (arrival) (°C)	35.61±0.9
Body temperature (exit) (°C)	36.11±0.6

Values are expressed as mean±standard deviation.

Discussion

Unavoidable heat loss despite the necessary precautions is a common condition in anesthetized patients, regardless of the type of anesthesia chosen.

In the post-operative period, hypothermia (decrease in body temperature below 36°C) is seen in 26–90% of patients undergoing elective surgery[7]. Factors such as prolonged operation times,[8] opening large body cavities for surgeries,[9] and room temperatures lower than 23°C[10] may contribute to the POH formation process. In our study, similar to the studies mentioned above, the incidence of hypothermia at the 60th min of the intraoperative period was found 46.3%, and the incidence of hypothermia at the time of admission to the post-operative recovery room was found 57.06%. We found that the incidence of hypothermia increased with prolonged anesthesia time in the geriatric population.

Hypothermia can increase morbidity rates by disrupting various systems. The most important cause of post-operative morbidity is cardiac complications. Ischemia, which develops as a result of decreased blood flow, causes cellular damage. Indeed, Sessler et al.[11,12] reported that hypothermia may increase cardiac complications. Some studies have reported that intraoperative hypothermia decreases the rate of wound healing through vasoconstriction and is a risk factor that causes an increase in surgical site infections[13,14]. In studies investigating the effects of moderate hypothermia (35°C), they reported that some anesthetic agents prolong the duration of action. They concluded that this effect is more pronounced in geriatric patients[15-17]. Because of all these effects of hypothermia, patients need to be warmed in the perioperative period. Active and passive heating methods are still used today. While it was reported that 38.5% of the patients were warmed in the perioperative period in Europe,[18] it was reported that this rate was 13.9%, and the incidence of post-operative hypothermia was 45% in the study conducted by Aksu et al.[19] in Turkey. In our study, 20.2% of the patients were warmed up and the incidence of post-operative hypothermia was 57.06%. However, active warming meth-

Table 3. Intraoperative body temperature (n=178)

	0th min	60th min	120th min	180th min	240th min	P
Body temperature (°C)	33.1–37.7	34.1–37.3	33.7–37.4	33.4–37.0	33.8–36.3	0.001**
	36.7	36.1	35.8	35.4	35.4	
	36.56±0.67	36.06±0.64	35.81±0.77	35.41±0.92	37.77±0.92	

Values are expressed as minimum, maximum, median, and mean±standard deviation. **Friedman test.

ods applied in the recovery unit ensured that all patients were normothermic at discharge. These findings suggest that the patients were not adequately warmed up in the pre-operative and intraoperative period; however, it made us think that the routine warming methods applied in this unit may be effective in the normothermic patients at discharge in our recovery unit.

To identify hypothermic patients, it is important to monitor body temperature and determine heating methods. Indeed, Zhang et al.[20] reported that in geriatric patients who underwent transurethral resection of the prostate, the compressed air heating system applied together with the electric blanket was more effective in maintaining body temperature compared to the devices alone. Similarly, another study reported that applying a warming blanket 10 min before induction of anesthesia reduced the incidence of hypothermia compared to a single layer cotton blanket[3]. In a retrospective study comparing young adult patients and geriatric patients, it was reported that the incidence of post-operative hypothermia was higher and the temperature drop was significant in geriatric patients. Therefore, the necessity of applying additional warming methods to prevent POH in geriatric patients has been emphasized[5]. All these studies show that different warming strategies can be helpful in keeping the body temperature constant in geriatric patients undergoing surgery under general or regional anesthesia.

Shivering, which may be caused by post-operative hypothermia, may lead to adverse conditions such as hypoxia, myocardial ischemia, and increased intracranial and intraocular pressure[21,22]. In our study, we encountered shivering in 34.3% of 102 patients who were determined to be hypothermic in the post-operative period, and this rate was significantly higher than the rate of shivering in patients who were not hypothermic.

The first limitation of our study was that the geriatric and non-geriatric age groups were not compared. If both groups were compared, the relationship between age and POH could be better evaluated; our second limitation was that the surgical grade and type of anesthesia applied were different in the patients.

Conclusion

In our study, POH emerges as an important problem in geriatric patients. We suggest that routine monitoring of body temperature and warming of patients are necessary to prevent hypothermia in geriatric patients. Improvements should be applied quickly so that hypothermia does not occur, especially in long-term operations.

Ethics Committee Approval: Study was approved by the Recep Tayyip Erdoğan University Non-Interventional Clinical Research Ethics Committee (date: 27/04/2018, number: 2018-91).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: L.K.; Design: Ş.B.; Data Collection or Processing: L.K., Ş.B.; Analysis or Interpretation: Ş.B.; Literature Search: L.K.; Writing: Ş.B., L.K.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study received no financial support.

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