

# BODY TEMPERATURE OF THE ELDERLY PATIENT IN THE POSTOPERATIVE PERIOD

*Temperatura corporal do paciente idoso no período pós-operatório*

*Temperatura corporal del paciente anciano en el período postoperatorio*

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**ABSTRACT: Objective:** To identify fever in elderly patients submitted to orthopedic surgery during the postoperative period. **Method:** This is a retrospective cohort study. Two hundred and sixty-two medical records of elderly people submitted to orthopedic surgery in the period from January 2013 to December 2015 were analyzed. Medical records from 60-year-old patients or older, with complete registration of their body temperature between the first and fifth postoperative days, were included. **Results:** We found that only 1% of the patients had fever during the postoperative period (38.7°C), and most of them were female patients (58%), aged around 74 years; 52% underwent osteosynthesis of the proximal third of the femur – an orthopedic surgical procedure that had as its main cause the proximal femur fracture (52%). **Conclusion:** The results found in the research indicate a necessary care, by means of which temperature is controlled after surgical procedures.

**Keywords:** Aged. Fever. Postoperative care.

**RESUMO: Objetivo:** Identificar a febre no idoso submetido à cirurgia ortopédica no período pós-operatório (PO). **Método:** Trata-se de um estudo de coorte histórica. Foram analisados 262 prontuários de idosos submetidos à cirurgia ortopédica, no período de janeiro de 2013 a dezembro de 2015. Foram incluídos os prontuários dos pacientes com idade maior ou igual a 60 anos, com registro completo da temperatura corporal entre o 1º e o 5º dia de pós-operatório (DPO). **Resultados:** Identificou-se que apenas 1% dos pacientes apresentou febre no período pós-operatório (38,7°C), sendo a maioria do sexo feminino (58%), com idade média de 74 anos; 52% foram submetidos à osteossíntese de terço proximal de fêmur, procedimento cirúrgico ortopédico que teve como maior causa a fratura de fêmur proximal (52%). **Conclusão:** Os resultados encontrados na pesquisa apontam para o cuidado necessário com o controle da temperatura após procedimentos cirúrgicos.

**Palavras-chave:** Idoso. Febre. Cuidados pós-operatórios.

**RESUMEN: Objetivo:** Identificar la fiebre en el anciano sometido a cirugía ortopédica en el período postoperatorio (PP). **Método:** Se trata de un estudio de cohorte histórica. Fueron analizados 262 prontuarios de ancianos sometidos a la cirugía ortopédica, en el período de enero de 2013 a diciembre de 2015. Fueron incluidos los prontuarios de los pacientes con edad mayor o igual a 60 años, con registro completo de la temperatura corporal entre el 1º y el 5º día de postoperatorio (DPO). **Resultados:** Se identificó que apenas el 1% de los pacientes presentó fiebre en el período postoperatorio (38,7°C), siendo la mayoría del sexo femenino (58%), con edad promedio de 74 años; un 52% fue sometido a la osteosíntesis de terço proximal de fêmur, procedimiento quirúrgico ortopédico que tuvo como mayor causa la fractura de fêmur proximal (52%). **Conclusión:** Los resultados encontrados en el estudio apuntan para el cuidado necesario con el control de la temperatura tras procedimientos quirúrgicos.

**Palabras clave:** Anciano. Fiebre. Cuidados posoperatorios.

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## INTRODUCTION

Body temperature is one of the physiological parameters that the organism controls most. The hypothalamus is the thermoregulatory center responsible for the coordination of the functions that intervene in the production and loss of heat, thus maintaining the temperature within the desired limits<sup>1</sup>. Even though the organism is subject to thermal variations, oscillations between 0.2 and 0.4°C (Celsius) to 37°C are allowed for maintaining the metabolic functions.

During the aging process, the thermoregulatory center requires efficiency and therefore may cause temperature oscillations under normal conditions. Based on this fact, the elderly constitute an important group of risk, because their temperature regulation capacity before cold or heat exposure decreases with age<sup>2</sup>.

The factors that may result in decrease of temperature perception include reduction in the number of sudoriferous and sebaceous glands in the skin, resulting in blood flow decrease; and reduction in the metabolism synthesis of the main neurotransmitters, which leads to a slower conduction of nervous impulses. Therewith, the elderly take longer to answer and react to extreme temperatures<sup>1</sup>.

In the surgical context, not only the elderly patient is subject to physiological changes due to the aging process, but also to thermoregulatory changes induced by anesthesia, by the surgery itself and by the surgical environment<sup>3</sup>.

Hypothermia is a frequent phenomenon in the Postanesthesia Care Unit (PACU), since there is inhibition of the physiological mechanism due to anesthesia, which can be attributed to age of the patient, temperature in the operation room, and action of anesthesia agents, which depress the thermoregulatory center<sup>4</sup>.

On the other hand, high body temperature in the postoperative period (PO) has been associated with both infectious processes and organism's physiological response to orthopedic surgical procedures<sup>5</sup>.

Temperature raise may be attributed to tissue injury caused by the surgical procedure, which develops the release of cytokines through tissue monocytes or macrophages, such as interleukin 1 $\beta$  (IL-1 $\beta$ ), tumor necrosis factor-alpha (TNF $\alpha$ ), and interferon- $\alpha$ , and all of them have a pyrogenic activity. These cytokines stimulate the production and secretion of interleukin-6 (IL-6), which is responsible for the acute inflammatory response. When this cytokine enters the blood flow and reaches the brain tissue, it synthesizes prostaglandin

E<sub>2</sub>, which is in charge of sending the signal to the pre-optical nucleus of the hypothalamus, thus raising the adjustment point of the body temperature<sup>6</sup>.

Fever in the PO is not only a physiological response, but it is also considered a defense mechanism, as well as a stimulus to interferon production in the organism. There is evidence that fever, during the PO, is the result of physiological response of the body and is an important signal of defense mechanism. Increases in temperature of up to 39°C intensify the body's immune system; the production of leucocytes is stimulated during the feverish episode; the iron concentration in the plasma is decreased and therefore the growth of bacteria is suppressed. Fever also fights against viral infections through the stimulation of interferon production, which is a molecule of combat against the natural virus of the organism<sup>7</sup>.

Therefore, temperature measurement becomes an important nursing care during the PO. Even though there are many places to perform this procedure in the Brazilian nursing practice, axillary temperature measurement is the most used due to its easy access and non-invasive advantages<sup>8</sup>.

Hence, the nurse must recognize the importance of measuring the temperature of elderly patients in the PO. The results of this measurement may orient the elaboration and implementation of a care plan to elderly patients after their surgery.

Thus, the aim of this study was to identify the occurrence of fever in elderly subjects, who underwent orthopedic surgery, during the PO.

## METHOD

A retrospective cohort study of quantitative approach was carried out based on the medical records of a patient admitted at a public hospital institution of traumatology reference teaching, located in the city of Belo Horizonte, State of Minas Gerais, in Brazil. The temperature records between the first and fifth postoperative days (PODs) of elderly patients who underwent orthopedic surgery, from January 2013 to December 2015, were analyzed, resulting in 262 medical records. The five-day period was chosen based on a review study in which the authors concluded that fever is manifested in the first 72 PO hours as a normal physiological response of the organism to the surgical trauma mediated by inflammatory cytokines<sup>5</sup>.

The following items were adopted as eligibility criteria: patients aged 60 years or older<sup>9</sup>, who were underwent

orthopedic surgery and received treatment between January 2013 and December 2015, and medical records with complete registration of body temperature during the first 5 PODs.

The list of patients was obtained from the database of the Information Technology Department of the hospital. Registered information from each patient was transferred and typed individually in an instrument structured with data regarding: subject's characterization, such as age, sex, and comorbidities; surgery (orthopedic surgery); and PO (patient's body temperature in the first five days).

The nursing team of the surgical hospitalization unit assessed the body temperature using a mercury-in-glass thermometer; the measurement was taken in axillary location and the result was registered in the patient's medical record according to the standard operational procedure (SOP) of the hospital institution. Temperature values corresponded to the first registration of the day, i.e. 6:00 in the morning. With regard to axillary body temperature, values above  $37.8^{\circ}\text{C}$  were considered as fever.

Data were stored in the Microsoft Office Excel 2007 program and processed in the Statistical Package for the Social Sciences (SPSS) program, version 19.0. Results were described as relative and absolute frequencies; and the continuous variables were presented with mean, standard deviation, maximum and minimum values. The research followed the requirements of Resolution 466/12 from the Brazilian Health Council (CNS) and had the previous consent of the institution, as well as a favorable opinion of the Research Ethics Committee from *Universidade Federal de Minas Gerais* (UFMG), under protocol no. CAAE – 14274913.0.0000.5149.

## RESULTS

A total of 262 elderly patients participated in the study. There was a higher prevalence of the female sex (58%). With regard to the age of the elderly, there was a mean of 74.4 years old, with variation between 61 and 95 years old. It is worth noting that 65.6% of them were between 60 and

79 years old. As to the kind of orthopedic surgeries, there was a predominance of femur osteosynthesis (52%), and the most common reason to perform the surgery was femur fracture (52%). Data can be verified in Table 1.

Table 2 results show that the mean temperature, throughout five days, did not present extreme variations between

**Table 1.** Frequency distribution of elderly patients according to sociodemographic and surgical variables. Belo Horizonte, MG, Brazil, 2015.

Variable	n	%	Mean (SD)
Sex			
Male	110	42.0	
Female	152	58.0	
Age (years)			
60–69	87	33.2	74.4 (9.79)
70–79	85	32.4	
80–89	67	25.6	
>90	23	8.8	
Type of surgery			
Proximal third of the femur osteosynthesis	137	52	
External fixation	24	9	
Total hip replacement	20	8	
Closed reduction	19	7	
Partial hip replacement	12	5	
Lower-extremity amputation	11	4	
Others	39	15	
Cause			
Proximal femur fracture	206	79	
Tibial fracture	18	7	
Hip fracture	11	4	
Ankle fracture	10	4	
Patellar fracture	9	3	
Ankle fracture	8	3	

SD: standard deviation.

**Table 2.** Distribution of elderly's body temperature values in the postoperative period. Belo Horizonte, MG, Brazil, 2015.

	First POD		Second POD		Third POD		Fourth POD		Fifth POD	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Mean temperature ( $^{\circ}\text{C}$ )	36.4	36.1	36.5	36.5	36.4	36.2	36.5	36.3	36.4	36.4
Maximum temperature ( $^{\circ}\text{C}$ )	37.5	38.7	37.9	38.2	38.2	38.0	37.9	37.3	38.2	37.9
Fever (%)	–	1	1	0.7	0.7	0.7	–	–	0.7	–

Source: Research data.  
POD: postoperative day.

sexes. After categorizing the temperature values, we found that only three (1%) patients had fever.

## DISCUSSION

The body physiological signals, such as temperature, heart rate, blood pressure, and respiratory rate, are accurate indicators of the individuals' health conditions. Therefore, body temperature measurement becomes part of the standard physical examination and is a decisive factor in many diagnostic deliberations<sup>10</sup>.

There was higher prevalence of the female sex in this study. This result is in agreement with previous studies on fractures on the elderly. However, the mean age was 74 years, which is different from the results obtained in the cities of São Paulo<sup>11</sup> and São Sebastião do Paraíso (Minas Gerais State)<sup>12</sup> that found average ages of 79 and 80 years, respectively.

Among the orthopedic surgeries, osteosynthesis of the proximal third of the femur was more prevalent. Osteosynthesis is known as the most recommended treatment for patients with femur proximal fracture owing to its earlier provision of stability and functional return. Increase of these fractures in the elderly population occurs mainly due to the larger incidence of falls and is associated with different factors, such as advanced age, osteoporosis, decrease of muscle strength, hip geometry, and genetic predisposal<sup>11</sup>.

The results from this study have showed that only three elderly patients (1%) developed fever in the first POD, which is different from data published in literature that varied between 8 and 36% during the first 72 hours of the PO period in hip and knee prosthetic surgeries. This explanation may be because fever is caused by cytokines (IL-1–IL6) that work as endogenous pyrogens and are released in the presence of tissue damage. Therefore, fever cannot be considered a sign of infection<sup>6,13</sup>.

It is worth noting that the mentioned studies included patients aged between 18 and 80 years. In this study, the population was composed of patients aged 60 years or older. Age influences not only the basal temperature, but also the febrile response. There is evidence that, during infectious processes, the maximum temperature achieved by the elderly patient may not satisfy the conventional standard of fever, i.e. temperature above 37.8°C<sup>14,15</sup>.

This thermal irresponsiveness standard may be attributed to several causes, such as thermogenesis disorders, that is, decrease of basal metabolism, of the muscle tremor efficiency

and peripheral vasoconstriction; reduction of production and sensitivity to IL-1, behavioral alterations and daily life activities<sup>16</sup>.

Another aspect that possibly influenced temperature values in this study was the anatomic place of measurement, i.e. the axillary in this case. A study carried out including the elderly population in an emergency unit from a German university hospital identified lower axillary temperature values in this group of patients, if compared to other measurement places. However, another study carried out in the cities of Múrcia and Toledo, in Spain, shows that temperature measurement in distal locations is a noninvasive method that is reliable and comfortable for obtaining temperature data<sup>16,17</sup>.

The measurement technique is associated with the temperature value result. The axillary measurement should be done as follows: place the patient in the supine position; guide him/her as to the movement of arm abduction and adduction; perform arm abduction until a 35° angle; dry the axilla of patient; put the thermometer parallel to the axilla medial wall of patient; touch his/her extremity in the axilla top and turn him/her by putting him/her perpendicularly to the medial wall; ask the patient to close the axillary cavity; inflect the forearm and place it on the thorax; loose it and note the time; remove the thermometer after 3 minutes and take the reading; finally, write down the result<sup>18,19</sup>.

Studies carried out with adults have found that axillae humidity, weight loss, malnutrition, skin folds, and adipose layer thickness may make it difficult to fit correctly the thermometer in the axillae and, therefore, change the result of its reading, thus creating the risk of recording false temperatures<sup>8-10,14</sup>.

Considering that information was obtained by means of electronic medical records in this study, it is hard to make conjectures about the technique used. It is assumed that the nursing team professionals followed the technique described in the SOP of the unit, which is not different from the previously described technique<sup>18-20</sup>.

Another important observation refers to the basal temperature measurement registration of post-operated elderly patients. The body temperature of the patient is known to possibly suffer variations based on the influence of factors such as emotional alterations, changes in the room temperature, presence of comorbidities, infectious processes, daily life activities, and circadian rhythm<sup>10</sup>.

The circadian rhythm of temperature usually presents oscillations during the day; then, in the morning, the temperature is lower if compared to that in the afternoon, when high temperature peaks are more evident. This variability may

be explained because, in the morning, the subject is found at a moment after his/her sleeping period and presents his/her basal temperature, and then the temperature increases when the subject returns to his/her routine activities<sup>10,16,18</sup>.

With regard to sex, in the present study, the mean temperature value was similar in both groups – female and male. These findings are in agreement with a study carried out with the general population of the cities of Múrcia and Toledo, in Spain, which identified that the temperature difference between sexes disappears in the elderly population<sup>16</sup>. Another study conducted with subjects aged 59 years or older, in the city of São Paulo, justified the increased temperature in the female sex due to the highest amount of adipose tissue<sup>21</sup>.

The results found in this research indicate the need of the nurse to pay attention to the proper technique for temperature measurement after surgical procedures. This implies recognizing the clinical signals and parameters that might contribute to the diagnosis of an infection or inflammation condition, not only considering the increase in temperature.

There is a need for a new research regarding temperature measurement in elderly patients, since there were only a few results of investigations published in the literature involving this group of patients.

The results of this study contribute to the nursing area, facilitating knowledge and understanding of the characteristics of the elderly population submitted to orthopedic

surgeries, which is a necessary phase for the implementation of care strategies in the perioperative period.

A methodological limitation of the study was the fact that data collection was carried out only in one hospital institution, which limits the generalization of the result.

## CONCLUSION

The sociodemographic profile of the elderly who underwent orthopedic surgical procedures was predominantly female. The mean age was 74 years old and the most conducted orthopedic surgical procedure was femur osteosynthesis. The most frequent etiology of the procedure was the proximal third of the femur.

Fever was found in the first POD – 38.7°C – in only 1% of the female patients. The basal axillary temperature of elderly patients who underwent orthopedic procedures presented mean values between 36.1 and 36.5°C in the first 5 PODs.

The results found in this research suggest that the values found in elderly patients require knowledge of the nursing team that go beyond the correct performance of the measurement technique. The nursing team should understand the aging process, the circadian cycle of the elderly's temperature and the factors that may change temperature at the time of measurement.

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