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Hypothermia in patients during the perioperative period

HIPOTERMIA EM PACIENTES NO PERÍODO PERIOPERATÓRIO

HIPOTERMIA EN PACIENTES EN EL PERÍODO PERIOPERATORIO

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ABSTRACT

The objective of this study was to identify the factors that trigger hypothermia in patients in surgery, and the manifestations in the anesthesia recovery room. This study was performed in a large hospital of the City of Santos hospital network. Data were collected from 30 adult patients, whose body temperature when entering the surgical suite was between 36°C and 37.2°C, who underwent elective procedures and received general anesthesia. Results show that the most common methods used to prevent hypothermia were infusing warmed intravenous fluids and using a thermal blanket. From the moment the patient left the surgical suite until 30 minutes post-recovery in the anesthesia recovery room, patients remained hypothermic. Hypothermia was manifested by hypoxemia and shivering. In this study, it was shown that hypothermia in patients is triggered while in the surgical suite due to the lack of appropriate preventive measures, leading to complications in the anesthesia recovery period.

DESCRIPTORS

Hypothermia
Operating rooms
Surgicenters
Perioperative nursing

RESUMO

O objetivo deste estudo foi identificar os fatores que desencadeiam a hipotermia em pacientes em sala de operação e as manifestações em sala de recuperação anestésica. O estudo foi realizado em um hospital de grande porte da rede mista da cidade de Santos. A coleta de dados foi realizada em 30 pacientes adultos, com temperatura corpórea na entrada da sala de operações entre de 36°C e 37,2°C, com procedimentos cirúrgicos eletivos e anestesia geral. Os resultados demonstraram que os métodos preventivos de hipotermia mais utilizados foram a infusão venosa aquecida e a manta térmica. Na saída da sala de operação e até 30 minutos na sala de recuperação anestésica, os pacientes permaneceram hipotérmicos. As manifestações de hipotermia foram demonstradas pela hipoxemia e por tremores. Neste estudo, evidenciou-se que a hipotermia no paciente é desencadeada na sala de operação pela falta de medidas preventivas adequadas, acarretando complicações em período de recuperação anestésica.

DESCRIPTORES

Hipotermia
Salas cirúrgicas
Centros de cirurgia
Enfermagem perioperatória

RESUMEN

Este estudio objetivó identificar los factores desencadenantes de hipotermia en pacientes en sala de operación y las manifestaciones en sala de recuperación anestésica. Fue realizado en hospital de gran porte de la red mixta de Santos-SP. La recolección de datos se efectuó con 30 pacientes adultos con temperatura corporal en entrada de quirófano entre 36°C y 37,2°C, con procedimientos quirúrgicos electivos y anestesia general. Los resultados demostraron que los métodos preventivos de hipotermia más utilizados fueron: infusión venosa precalentada y manta térmica. A la salida del quirófano y hasta los 30 minutos en sala de recuperación anestésica, los pacientes permanecieron en hipotermia. Las manifestaciones de hipotermia se demostraron por hipoxemia y temblores. En este estudio se evidenció que la hipotermia en el paciente se desencadena en el quirófano por falta de medidas preventivas adecuadas, acarreando complicaciones en el período de recuperación anestésica.

DESCRIPTORES

Hipotermia
Quirófanos
Centros quirúrgicos
Enfermería perioperatoria.

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INTRODUCTION

Normothermia is determined by a body temperature between 36°C and 38°C. The variations are related to the place of verification, such as oral, esophageal, axillary, rectal and tympanic temperature, and the normal range for adults is considered between 36.1 °C and 37.2 °C⁽¹⁻²⁾.

Hypothermia is determined by a body temperature under 36°C, and may be considered mild, medium or moderate, and serious or severe. It consists of a clinical state of body temperature under the normal range, in which the body is incapable of generating enough heat to perform its functions regularly⁽²⁾.

In the intraoperative period, hypothermia may be triggered by several factors, such as anesthetic agents, environmental temperature, exposure time to an environment with low temperature, cold venous infusions, and systemic disorders. It may be also related to risk factors, such as extremes of age, metabolic diseases, and neurologic disorders.

If patient hypothermia is not prevented in the perioperative period in the surgery room (SR), it may trigger complications during the anesthesia recovery (AR) period, as well as in the postoperative period (PO). Those complications can be respiratory, cardiovascular, of the skin, among others.

Surgical patients may present secondary hypothermia to general anesthesia and to the infusion of large volumes of crystalloids, cold hemoderivatives. Older patients seem to have a physiological predisposition to hypothermia⁽³⁾.

The loss of heat is common in all the patients during general anesthesia, since the anesthetics change the center of thermoregulation of the hypothalamus, inhibit shivering and produce peripheral vasodilatation. During anesthesia, the patient does not show thermal regulation responses because reflex is inhibited. During anesthesia recovery, the inhibition disappears and shivering begins when the temperature is under the threshold of thermal regulation⁽⁴⁾.

Some systemic disorders, such as hypothyroidism, may cause the body temperature to drop. The American Society of Anesthesiologists (ASA) developed a classification for the physical conditions of patients submitted to the anesthetic-surgical procedure, aimed at offering uniform general lines in the assessment of the seriousness of systemic diseases, physiological dysfunctions and anatomic abnormalities⁽³⁻⁴⁾.

The environmental temperature is another important factor in the regulation of the body temperature in

SR (surgery rooms). The Ministry of Health recommends the temperature in the surgery rooms to be between 19°C and 24°C, regardless of the type of procedure being performed⁽⁵⁻⁶⁾.

The ventilation system must provide an environmental temperature between 22°C and 23°C. Surgeries performed at temperatures under 21°C may cause hypothermia in the patients. In order to prevent this intraoperative complication, the use of thermal blankets or mattresses is recommended⁽⁵⁻⁷⁾.

Severe hypothermia also interferes in the rhythm and conduction of the heart with the occurrence of dysrhythmia. There is also deviation of hemoglobin dissociation curve to the left, contributing to a poorer oxygenation of the tissue; a reduction of the peripheral perfusion and decrease of the biotransformation of drugs, which may increase the duration of the action of neuromuscular blockers, sedatives, hypnotics and halogenated anesthetics,

thus increasing the time of anesthetic recovery and prolonging unconsciousness; increase of the incidence of shivering, which may cause a large increase in the consumption of oxygen (400% to 500%), in the production of carbon dioxide and the cardiac and respiratory demands; greater blood viscosity and the occurrence of moderate coagulopathy, due to the visceral sequestration of platelets, decrease of the platelet function and reduction in the activity of the coagulation factors and decrease of factors related to the immunity, which increases infections and the length of stay^(3-4,8).

Hypothermia also causes complications such as the increase of cardiac morbidity, infection in the surgery site, the effects of the anesthetic drugs, permanence of the patient at the AR, coagulopathy, hormonal alterations and the presence of muscular

shivering⁽⁹⁾.

The prevention of heat loss begins in the surgery room, since the patient under general anesthesia does not produce heat and depends on the environmental temperature⁽³⁻⁵⁾. The prevention measures must include increasing the environmental temperature in the surgery room. Active rewarming involves methods immediately available at the surgery room, including the administration of warmed intravenous fluids and the use of heat radiation lamps and thermal blankets, especially those that spread hot air over the body surface. The rewarming of the airways if less effective because the content of heat in the gases is minimum^(3-5,7,10-11).

Some studies were developed with the objective to point out nursing diagnoses and/or complications in the intraoperative period, and hypothermia was reported in many of these studies.

If patient hypothermia is not prevented in the perioperative period in the surgery room (SR), it may trigger complications during the anesthesia recovery (AR) period, as well as in the postoperative period (PO). Those complications can be respiratory, cardiovascular, of the skin, among others.

The results of a study developed in a hospital of the city of Santos network, aimed at pointing out the nursing diagnoses in the complications at the AR, showed that 80% of the patients presented hypothermia, with temperatures between 35°C and 35.5°C⁽¹²⁾.

Hypothermia was diagnosed in 67.8% of the cases reported in a study developed at the Post-Anesthesia Recovery Center at the Ribeirão Preto Faculty of Medicine (University of São Paulo - USP) Teaching Hospital, which had the objective to identify the most frequent nursing diagnoses in the immediate postoperative period⁽¹³⁾.

A study⁽¹⁴⁾, performed with the objective to identify nursing diagnoses in adult patients in the transoperative period of cardiac surgery, identified that 94.1% of the cases presented risk for altered body temperature.

Hypothermia was the second most prevalent complication in the AR (n=174, 43%) in a study developed at a large private hospital in the city of São Paulo⁽¹⁵⁾.

Although hypothermia is a common complication in the AR period, the lack of studies on this matter is noted in a literature review, with international magazines classified as Qualis B and C, and national magazines A and B. This study showed that, out of 297 editions found, four treated hypothermia as a nursing diagnosis with the main factors related and one recommended the prevention of this complication⁽¹⁶⁾.

It is necessary to study the factors that cause hypothermia in the SR and the prevention methods in the intraoperative period in order to minimize the complication in the postoperative and anesthetic recovery periods, and, consequently, improve the quality of the nursing care.

Therefore, the objective of this study is to investigate the factors causing hypothermia in patients while in the SR and the occurrences in the period of AR.

METHOD

This exploratory, descriptive study, was performed with quantitative approach at a large hospital institution in the city of Santos network. The surgicenter assists all specialties and offers 603 surgical and clinical beds, 22 surgery rooms and one anesthetic recovery room with nine beds. In 2008, an average 720 elective surgeries and 260 emergency surgeries were performed each month.

The study project was approved by the Research Ethics Committee of the referred institution (review number 077/2008). The Free and Informed Consent Form was presented to all the patients and/or legal guardians, and through this term they could agree or not to participate in the study, being aware that they were free to reject participation.

As these subjects were in immediate preoperative period, they were located according to the daily surgery schedule, and the consent form was presented to the patient by the authors before administering the pre-anesthetic medication.

The inclusion criteria were: adults (between 18 and 64 years), elective surgical anesthetic procedure, general anesthesia, axillary temperature when entering SR between 36°C and 37.2°C, and signing the consent form.

The exclusion criteria consisted of factors of possible thermoregulation alterations, such as extremes of ages (under 18 and over 64 years); thyroid disorders; neurological disorder; shock manifestations; ASA classification 5 and 6; axillary body temperature under 36°C or over 37.2°C when entering the SR; surgery anesthetic procedure of urgency or emergency and regional or local anesthesia.

Data collection was performed by three researchers, in July 2008. The sample consisted of 30 patients, defined according to the number of variables initially proposed, in other words, including all the patients who met the inclusion criteria.

A two-part structured instrument was designed for data collection: part 1, with data regarding sociodemographic aspects, gender, age, and data related to the surgical anesthetic procedure, such as medical diagnosis, surgery performed, ASA classification, time of permanence in SR, and duration of the anesthesia and surgery; and part 2, with data regarding hypothermia, axillary temperature of the patient when entering and leaving the SR; temperature of the SR; methods of hypothermia prevention performed at the SR; axillary temperature during the first hour at the AR room, every 15 minutes; manifestations and treatment of hypothermia in AR.

The hypothermia prevention methods used in the SR and treatment in the AR considered in this study were: warmed venous infusion (warmed serum), thermal blanket, thermal mattress, common mattress and bandaging of the limbs with orthopedic cotton. The common sheet was considered as a method for maintaining privacy.

Data were analyzed using descriptive statistics; quantitative variables were described with means, presented in absolute and relative frequencies.

RESULTS

Sociodemographic aspects

Data indicated that 21 (70.0%) patients – most of the sample – were female, between 18 and 64 years of age (mean age 35.3 years), and the highest frequency in the interval between 28 and 38 years – 10 (33.3%).

Surgical anesthetic aspects

Regarding the medical diagnosis, the patients scored the mean of 1.5 diagnoses, and the gynecology specialty was the most frequently presented – 7 (23.3%) – with uterine leiomyoma, endometrial glandular hyperplasia, endometrial thickening and polyp of the uterine body.

The diagnostic hysteroscopy with biopsy, surgical anesthetic procedure that presented the most frequency – 7 (23.3%) –, corroborated the medical diagnosis.

In the ASA classification, 16 (53.4%) patients were classified as ASA 1, followed by 14 (46.6%) classified as ASA 2. There was no classification of ASA 3 and 4.

Concerning the time of permanence in the SR, the mean permanence was 2h40, and most patients – 9 (30.0%) – were distributed in the interval between 1h and 2h.

The mean anesthesia duration was 2h24 and the most frequent interval was between 1h and 2h in 12 (40.0%) samples, whereas the mean surgery duration was 1h20 and the highest frequency, in 16 (53.6%) patients, was less than 1h, according to Table 1.

Table1 – Distribution of frequency of the patients, according to the time of permanence in SR and the duration of anesthesia and surgery – Santos, SP – 2008

Time/duration	Less than 1		1 to 2 hours		2 to 3 hours		Over 3 hours	
	N	%	N	%	N	%	N	%
Permanence in the SR	7	23.4	9	30.0	6	20.0	8	26.6
Duration of the anesthesia	10	33.3	12	40.0	2	6.60	6	20.0
Duration of the surgery	16	53.6	5	16.6	5	16.6	4	13.3

Aspects of the hypothermia

Considering the methods of hypothermia prevention in the SR, the study analyzed the use of warmed venous infusion (warmed serum), thermal blanket, thermal mattress, common blanket and bandaging of the limbs with orthopedic cotton.

The mean number of hypothermia prevention methods used in SR was 0.6 method per patient.

The warmed venous infusion was used in 12 (40.0%) patients, whereas the thermal blanket was used in 6 (20.0%) patients. The thermal and the common mattress were not used in any patient.

All the patients (30) were covered with a sheet, which was considered a measure to maintain privacy, rather than to prevent hypothermia.

Table 2 indicates the temperature of the SR when the patient entered and left the room. In 13 (43.3%) cases the temperature in the SR was between 15°C and 16.9°C, followed by 12 (40.0%) cases between 19°C and 24°C. When the patient left the SR, there was no significant change in the temperature of the room.

Table2 – Distribution of frequency of the patients, according to the temperature in the SR when the patient entered and left the room – Santos, SP – 2008

Temperature in the SR – °C	Patient entrance		Patient exit	
	N	%	N	%
15.0 – 16.9	13	43.3	12	40.0
17.0 – 18.9	5	16.6	6	20.0
19.0 – 24.0	12	40.0	12	40.0
Total	30	100.0	30	100.0

The axillary temperature of the patients when they entered and left the SR is represented in Table 3. At the SR entrance, all patients presented temperature in the interval from 36°C to 37.2°C, according to the criteria of inclusion in the sample. At the SR exit, 22 patients (73.3%) presented axillary temperature in the interval from 35.1°C to 35.9°C and 7 (23.4%) patients under 35°C.

Table3 – Distribution of frequency of the patients, according to axillary temperature when entering and leaving the SR – Santos, SP – 2008

Axillary temperature - °C	SR entrance		SR exit	
	N	%	N	%
Under 35.0	-	-	7	23.4
35.1 – 35.9	-	-	22	73.3
36.0 – 37.2	30	100.0	1	3.3
Total	30	100.0	30	100.0

Regarding the time of permanence in the AR – 24 (80.0%) patients stayed in AR from 1 to 2 hours and 6 (20.0%) from 2 to 4 hours.

Table 4 shows that 24 (80.0%) of the patients remained hypothermic until 30 minutes of permanence in the AR, with axillary temperature between 35.1 °C and 35.9 °C.

After staying in AR for 30 minutes, most patients started to rewarm; a fact observed, in 60 minutes, in 18 (60.0%) of the patients with axillary temperature between 36°C and 37.2°C.

Regarding the hypothermia treatment methods in the AR, a common blanket was used in 23 (76.6%) of the patients and a thermal blanket in 7 (23.4%). The warmed venous infusion and the thermal mattress were not used in any patient.

Table 4 – Distribution of frequency of the patients, according to the axillary temperature, during the permanence of 60 minutes in the AR – Santos, SP – 2008

Axillary temperature - °C/time minutes	0		15		30		45		60	
	N	%	N	%	N	%	N	%	N	%
Under 35.0	7	23.4	3	10.0	1	3.3	1	3.3	1	3.3
35.1 – 35.9	22	73.3	22	73.3	24	80.0	12	40.0	5	16.6
36.0 – 37.2	1	3.3	5	16.6	5	16.6	17	56.6	18	60.0
37.3 – 38.0	-	-	-	-	-	-	-	-	6	20.0
Total	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0

As for the clinical manifestations of the hypothermia in the AR, the mean was 1.83 per patient. The highest frequency was for hypoxemia in 22 (73.3%) patients, observed by the need to use supplementary oxygen through a mask to maintain the peripheral saturation of oxygen over 91.0%.

Shivering was observed in 20 (66.6%) patients, skin paleness in 8 (26.6%) and arterial hypertension in 5 (6.6%).

DISCUSSION

Regarding the sociodemographic aspects, the highest frequency was verified in females and there were no significant differences of axillary temperatures among males, which disagrees with studies that have indicated that the temperature of females is up to 0.5°C lower than males⁽¹⁾.

Age was another sociodemographic aspect analyzed, as the extreme of ages, considered a risk factor for hypothermia^(3,17), was considered as an exclusion criterion in this study.

Among the aspects related to the anesthetic-surgical procedure, the study considered the classification of the American Society of Anesthesiologists (ASA), and most patients were classified as ASA 1 and 2, no patient was classified as ASA 3 and 4. The ASA classification assesses the severity of systemic diseases, physiological dysfunctions and anatomical abnormalities; and does not directly approach the body temperature, but is related to the disorder carried by the patient, which can increase or reduce his/her body temperature^(3-4,8-9).

The mean time of permanence at the SR and the duration of the anesthesia and the surgery were 2h40min, 2h24min and 1h20min, respectively. The longer the surgery, the lower the patient's body temperature^(10,18).

A study developed at a hospital in the interior of the state of São Paulo, aimed at identifying the factors related to the development of hypothermia in the intraoperative period, showed a statistically significant difference between the patients' mean body temperature and the variables: duration of the anesthesia, type of anesthesia, duration of the surgery, temperature in the surgery room, BMI and blood transfusion⁽¹⁸⁾.

In this study, it was observed that the temperatures in the SR remained significantly under the recommenda-

tion of the Ministry of Health, which is between 19°C and 24°C, regardless the type of procedure to be performed⁽⁶⁾.

Surgeries performed at temperatures under 21°C may cause hypothermia. In order to avoid this intraoperative complication, the use of thermal blankets or mattresses is recommended⁽⁴⁾.

In this study, the mean number of hypothermia prevention methods used in the SR was 0.6 per patient, and the most used methods in the SR were warmed venous infusion and thermal blanket. Most patients who received a hypothermia preventive method in the SR left the room with axillary temperature between 35.1°C and 35.9°C, thus, the method was effective to avoid hypothermia under 35°C. Most patients who did not receive any hypothermia preventive method presented axillary temperature under 35°C. Patients with temperature over 35°C rewarm passively during the recovery period, although moderate shivering may occur⁽⁸⁻⁹⁾.

Researchers who have studied intraoperative hypothermia performed a systematic review and reported that the implementation of skin heating systems in order to avoid hypothermia is a crucial measure for surgical patients. Based on the elaborated review, their conclusion is that there is moderate evidence when suggesting that carbon fiber blankets are as effective as the system of forced air heating to avoid hypothermia and that water circulation clothes are the most effective method to maintain normothermia⁽¹⁹⁾.

Among the main prophylactic methods for hypothermia in the SR, there is: maintenance of the environmental temperature between 22.0°C and 24.0 °C; use of environment heaters; use of warmed crib for newborns; covering the body surface with woolen blankets, heat, infusion of warmed solutions⁽⁸⁻⁹⁾.

In the AR, the most used preventive methods were the common and the thermal blanket. A study developed at a hospital institution in the city of São Paulo, regarding the nurse interventions and the complications in the AR, indicated that hypothermia was the second most frequent complication in AR, preceded by the pain, and it had a significant relationship with the use of a thermal blanket⁽¹⁵⁾.

This study observed clinical manifestations of hypothermia, such as hypoxemia, shivering, skin paleness and arterial hypertension. The main side effects of hypo-

thermia were: exacerbation of the sympathetic nervous system; increase of the systemic vascular resistance; decrease of the venous capacitance and arterial hypertension; increase of the incidence of shivering, which may determine a great increase in the consumption of oxygen (400% to 500%), of the production of carbon dioxide and cardiac and respiratory demands^(3-4,15).

CONCLUSION

Regarding the sociodemographic aspects, this sample consisted mainly of female subjects, with, in average, 35.3 years of age.

In the surgical anesthetic aspects, the most frequent medical diagnostics were those of endometrial problems, with surgical anesthetic procedure of diagnostic hysteroscopy and endometrial biopsy, and ASA classifications 1 and 2.

As for the aspects related to hypothermia, the mean periods of permanence in the SR, duration of the anesthesia and the surgery were 2h40, 2h24 and 1h20, respectively.

The mean number of hypothermia preventive methods used in the SR was 0.6 per patient, and the means for warmed venous infusion and thermal blanket were 40.0% and 20.0%, respectively. The common sheet was used in all the patients, which this study considers to be a method for privacy maintenance.

All the patients who received hypothermia preventive methods in the SR left the room with axillary temperature between 35.1°C and 35.9°C. Patients who did not receive any hypothermia preventive method left the room with temperature under 35°C, remaining hypothermic for 30 minutes in AR.

The temperature in the surgery rooms is another factor that may have contributed for the hypothermia of the patients to remain under the recommended by the Ministry of Health in 43.3% of the cases.

The methods to treat hypothermia in the anesthesia recovery were the common and the thermal blanket. The thermal mattress and the warmed venous infusion were not used.

The most frequent clinical manifestation of hypothermia was hypoxemia, followed by shivering, skin paleness and arterial hypertension.

It was concluded that patients develop hypothermia in the surgery room (SR), which remains in the anesthetic recovery (AR), triggering undesired clinical manifestations.

The nurse has an important role in the implementation of hypothermia preventive measures in the surgery room, avoiding the complications it brings in the anesthetic recovery, aimed at improving the quality of the nursing care provided in the perioperative period, greater safety for the patient, and reducing hospital costs.

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