HYPOTHERMIA CONTROL IN ELDERLY SURGICAL PATIENTS IN THE INTRAOPERATIVE PERIOD: EVALUATION OF TWO NURSING INTERVENTIONS[1]

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Objectives: To evaluate the efficacy of two different nursing interventions regarding control of body heat loss, using blankets during the intraoperative period of elderly patients. Methods: This was an experimental, comparative, applied, longitudinal prospective study with a quantitative approach. Eighty-one elderly patients undergoing elective surgery with a surgical time frame of at least one hour were selected by systematic probability sampling into two Experimental and one Control Group. Informed consent was obtained from participants. Data was collected by biophysiological measurement, using a tympanic thermometer. Results: After the homogeneity of variables – gender, surgical duration, age, BMR, anesthesia, room humidity and temperature, drugs and liquid infusion- had been demonstrated, the interventions were confronted. Incidence of hypothermia (59.3%) and body heat loss (E1=-0.6°C , E2=-0.6 °C and C=-0.7°C) were not significantly different between the groups (p=0.85 and p=0.7 respectively). Conclusions: Results show the need for associated extra body warming methods to maintain normothermia.

DESCRIPTORS: evaluation of results of therapeutic interventions; body temperature regulation; hypothermia

CONTROL DE LA HIPOTERMIA DE PACIENTES QUIRÚRGICOS ANCIANOS EN EL INTRAOPERATORIO: EVALUACIÓN DE DOS INTERVENCIONES DE ENFERMERÍA

Objetivo: Verificar la eficacia de dos intervenciones de enfermería en el control de la pérdida de temperatura corporal, utilizando mantas, en el intraoperatorio de pacientes quirúrgicos ancianos. Método: La investigación fue experimental, comparativa, de campo, aplicada, longitudinal prospectiva, con aproximación cuantitativa. Ochenta y uno ancianos, bajo cirugía electiva, con tiempo quirúrgico mínimo de una hora, fueron divididos a través de muestra probabilística, sistemática en dos grupos experimentales y un control. Los datos fueron recolectados por medida biofisiológica, a través de termómetro timpánico. Resultados: Tras demostrar la homogeneidad de las variables: sexo, porte quirúrgico, edad, IMC, anestesia, temperatura y humedad ambiente, drogas e infusión líquida, las intervenciones fueron comparadas entre si. La incidencia de hipotermia y promedio de pérdida de calor corporal (E1=-0,6°C, E2=-0,6 °C y C=-0,7°C) no han sido estadísticamente diferentes entre grupos (p=0,85 e p=0,7 respectivamente).Conclusión: Los resultados han demostrado la necesidad de métodos adicionales de calentamiento corporal para manutención de la temperatura.

DESCRIPTORES: evaluación de resultados de intervenciones terapéuticas; regulación de la temperatura corporal; hipotermia

CONTROLE DA HIPOTERMIA DE PACIENTES CIRÚRGICOS IDOSOS NO INTRAOPERATÓRIO: AVALIAÇÃO DE DUAS INTERVENÇÕES DE ENFERMAGEM

O objetivo deste estudo foi verificar a eficácia de duas intervenções de enfermagem no controle da perda de temperatura corporal, utilizando cobertores no intra-operatório de pacientes cirúrgicos idosos. O estudo foi experimental, comparativo, de campo, aplicado, longitudinal prospectiva, com abordagem quantitativa. Oitenta e um idosos, sob cirurgia eletiva, com tempo cirúrgico mínimo de uma hora, foram divididos através de amostragem probabilística sistemática em dois grupos experimentais e um controle. Os dados foram coletados por medida biofisiológica, através de termômetro timpânico. Após demonstrar homogeneidade das variáveis - sexo, porte cirúrgico, idade, índice de massa corpórea (IMC), anestesia, temperatura e umidade ambiente, drogas e infusão líquida -, as intervenções foram comparadas entre si. A incidência de hipotermia (59,3%) e média de perda de calor corporal (E1=-0,6°C , E2=-0,6 °C e C=-0,7°C) não foram estatisticamente diferentes entre os grupos (p=0,85 e p=0,7, respectivamente). Os resultados demonstram necessidade de métodos adicionais de aquecimento corporal para manutenção da temperatura.

DESCRITORES: avaliações de resultado de intervenções terapêuticas; regulação da temperatura corporal; hipotermia

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INTRODUCTION

Intraoperative hypothermia is common, with an incidence of around 60%. It is a result of the disorganization in thermoregulation, caused by anesthesia, the type or dimension of the surgery and by the surgical environment[1].

The main importance of this fact resides in the evidence of severe consequences of the physiological alterations due to hypothermia, such as the diminished blood flow in all systems, cardiac arrhythmias, increased tissular demand of oxygen by 400% to 500%, diminished metabolism, impaired platelet function, increased susceptibility to surgical wound infection, among others[1-2].

The body temperature is controlled by the balance between heat loss and production. To maintain it, the organism basically works with two regulatory mechanisms: physiological - redistribution of heat between the central and peripheral compartments through shiver and no shiver mechanisms -, and behavioral control - regulation of environmental temperature and use of clothes[3].

Since the physiological mechanism is inhibited by the anesthesia, several authors recommend covering the patient's exposed area during surgical procedures in order to protect him(er) from cold[1,4-6]. They also affirm that a simple layer of some warming element diminishes heat loss by 30%[3].

The warming methods can be passive - thermo isolation such as blankets, aluminum blankets -, or active - air warming blankets, thermal mattress-, all over the body except for the surgical site[1,4].

Studies diverge on which method is the most effective. In most cases, active warming has better results, especially through air warming blankets, keeping the body temperature close or equal to normothermia[5,7-8].

Regarding passive warming, some studies show that normothermia can be maintained because this method isolates the patient from the cold temperature of the surgical environment by keeping a layer of air close to the skin, thus reducing heat loss through radiation and convection[1,9].

Considering that active warming through an air warming blanket remains a technology that demands high investment and that many health institutions do not have such financial resources available to permit this purchase, we decided to test the body temperature control method, which is simple and accessible to any health institution - the passive heating method through the use of blankets.

The elderly constitute an important risk group due to the physiological alterations that occur in the aging process and contribute to a diminished thermoregulation[1] capacity. It is believed that the results of the proposed interventions for this specific population can also be prescribed to the population in general.

The study hypothesis is that, by using blankets on the patient's exposed regions other than the surgical site, it will be possible to control the elderly's loss of body temperature during the intraoperative period, taking into account the moderating variables.

In summary, this study aimed to verify the efficacy of two nursing interventions during the intraoperative period in elderly surgical patients, considering the moderating variables. Specifically, to verify the efficacy of the use of blankets in all regions exposed during surgery (lower and upper limbs, head and back region) during the intraoperative period; to verify the efficacy of using blankets on the dorsal region only and, finally, to compare the two interventions mutually and with the usual procedure (without specific care for hypothermia control).

CASES AND METHOD

This is an experimental, comparative, field, applied, longitudinal and prospective study with a quantitative approach.

The study site was the surgical center of a charitable, medium-sized general hospital. The surgical rooms' characteristics were similar: dimensions, finishing characteristics and air conditioning without temperature control.

The sample was composed of 81 elderly people over 60 under elective surgery, with a minimum duration of one hour, who gave their written agreement. The sample size was determined using a 5% significance level and a 90% test power, based on the standard error of previous studies.

The study was approved by the Committee of Bioethics from the Regional University Hospital of Northern Parana, Brazil. The written authorization was asked at the moment each patient arrived at the Surgical Center, after clarification about the research and its objectives. The consent was signed in two copies, one for the patient and the other for the research files.

The cover used was an acrylic woolen blanket of approximately 1.80m x 1.60m, always isolated by a cotton sheet. To protect the head, a cap of the same material as the blanket was used over the disposable one. This material does not warm but keeps the patient isolated from the environment temperature through a layer of air between the body and the blanket.

To compose the study groups, a probabilistic sample technique was used, that is, a draw in which the first drawn name was part of Experimental Group I, the second of Experimental Group II and the third of the Control Group. This was performed successively until 27 patients were designated to each group.

The study groups were defined as following: Experimental Group I (GE-I) - patients with the entire body covered except for the surgical site-; Experimental Group II (GE-II) - dorsal region warmed with cover-; Control Group (GC) - hospital routine maintenance (without specific care for warming the patient).

In this study, the independent variables were the nursing interventions in Experimental Groups I and II, the dependent variable was the variation of central temperature and the moderated variables were: kind of anesthesia, medication, quantity of fluid received intravenously (warmed or not), body mass index (BMI), surgery dimension and temperature of the Surgical Room (SR). The latter do not constitute inclusion or exclusion criteria, although they were controlled in order to demonstrate the homogeneity between the three groups.

The data collection was performed from December 1999 to February 2000 by biophysiological measures, through ear temperature measurement, since this is one of the most reliable temperature measures of the thermoregulatory center of the hypothalamus. Temperature was verified through an ear thermometer (Thermoscan, Model HM - 2). The verification of room temperature and humidity was also performed through thermohygrometer Lutron HT - 3003.

The data were registered in forms containing the identification data related to the moderating variables and body temperature records.

DATA COLLECTION PROCEDURE

After the patients' reception at the Surgical Center, they were approached regarding the authorization to participate in the research. The surgical room was already prepared according to the study group in which the patient was designated.

Right after the anesthetic induction, the first measurement of ear temperature was done concomitantly with room temperature and relative humidity. Measurements were done in the following order: at the moment of induction, then 15 minutes, 30 minutes and 1 hour after the anesthetic induction.

The decision to use warmed venous infusion was taken by the anesthetic team, that is, each anesthesiologist's work routine was respected.

DATA TREATMENT

To analyze the continuous variables: age, temperature and body mass index, maximum and minimum values, mean, standard error and median were observed. The classificatory variables, gender and type of anesthesia, were analyzed through absolute and relative frequencies.

To evaluate the homogeneity of the three groups, Chi Square and Fischer's tests were applied. The analysis of variance test to one factor was used to compare the means of the three independent groups and Kruskal-Wallis' non-parametric test for intergroup comparisons.

The variance of analysis test was used to evaluate the factors that influenced temperature variations. The correlation between the two variables was analyzed by Pearson's coefficient correlation.

The multiple linear regression analysis evaluated the correlation between several variables and temperature variation. Finally, for the groups' behavior in relation to the conditions under study, repeated measures analysis.

All the tests were performed in the two-tail form, admitting a 5% probability of error.

RESULTS AND DISCUSSION

The patients' average age was: GC: 68.2, GE - I: 69 and GE - II: 66.6 ($p= 0.589$). Regarding gender, in the GC, there were: 13 women and 14 men, in GE - I: 15 women and 12 men and, in GE - II: 14 women and 13 men ($p= 0.862$).

At the beginning, the moderating variables were analyzed isolatedly, in order to determine the

homogeneity between the groups, so that the independent research variables would be the focus of the study.

Table 1 - Clinical and procedures characteristics of the patients studied. Londrina, 2000

Characteristic	G. Experimental I	G. Experimental II	G. Controle
Surgical Dimension - n			
Medium	7	10	7
Large	19	16	19
Special	1	1	1
Type of Anesthesia - n			
Blockade	18	17	19
General	14	11	10
Infusion Volume - ml			
Warmed	1750	1136	1125
Not warmed	1206	1264	761
BMI - %			
Medium	23.97	25.54	25.85
Drugs - n			
Benzodiazepine	12	14	12
Local Anesthesia	21	19	22
Muscle Relaxation	13	11	9
Halogen Anesthesia	12	8	7
Endovenous anesthesia	13	9	6
Hypnoanalgesia	21	21	21
Non-halogen anesthesia	6	2	3
Barbituric	2	4	4

There was no significant difference between the three groups studied, as shown in Table 1, regarding the moderating variables (kind of anesthesia (p=0.760), medication, quantity of liquid infused - warmed or not (p=0.783), BMI (p=0.176), surgical dimension (p=0.933).

Patients were distributed homogeneously regarding surgical dimension (p=0.933), while most surgeries (66.7%) were large-size. The importance of this classification is the substantial loss of body heat through the surgical incision and greater exposure of the patient[10].

There was no significant differences either regarding the type of anesthesia performed (p=0.760). It was also analyzed whether the anesthesia was general (with closed system) and blockade - spinal or epidural, and the following respective values were obtained: p = 0.251, p = 0.205 and p= 0.183. The body temperature variation was also evaluated according to the type of anesthesia. These results also demonstrated, once more, the homogeneity between the groups. The average body temperature in patients under general anesthesia with closed system obtained p = 0.265, those under spinal anesthesia obtained p = 0.651, and those under epidural p = 0.745.

Some authors affirm that the type of anesthesia used can interfere in the body temperature due to heat loss through evaporation (general anesthesia)[1-3,5]. Another problem is the blockade of afferent impulses (which takes the information of cold or heat to the CNS - Central Nervous System), because it expands the vasoconstriction and shivering threshold[2-4].

Heat loss through the administration of intravenous fluids at ambient temperature is not considered one of the most significant forms of body temperature reduction[10] because, as the fluid is being administered, it is warmed by the blood and tissues. However, it is known that, even though the infusion of warmed intravenous fluids does not cause immediate effects, its result is thermogenic, that is, there is less incidence of shivering during anesthetic recovery (time and intensity). It is also recommended that, for a more effective result, this method should always be associated with other warming techniques.

The patients' body temperature in this study was not influenced by the volume infused, neither by the solution temperature (p=0.783). In the analysis of the: (volume infused) X (warmed or not) X (body temperature variation) for those patients who received warmed solution, p was 0.548 and, for those who received non-warmed solution, p was 0.521.

The BMI has an important role in thermo control, because the body mass works as an isolator or thermo barrier, especially in the subcutaneous adipose tissue. In this study, patients' BMI in the three groups were within normal parameters and did not interfere in body temperature variation. A value of p = 0.176 was obtained for the BMI means and a p = 0.842 for the body temperature variation related to this variable.

Several studies have appointed that drugs influence surgical patients' temperature variation[1,3-4,6]. In this study, the drugs were analyzed isolatedly, considering only their use. The result showed that the three groups were under the same influences, demonstrating their homogeneity.

Another important variable is the anti-septic agent, because it can cause heat loss from the body surface by evaporation, especially when it contains alcohol[1]. In this study, the same anti-septic was used in all patients: polyvinylpyrrolidone iodine

(PVPI), in order to maintain homogeneity between the groups.

Table 2 - Distribution of temperature (tpt) and relative humidity (RH) means of the surgical room (SR) at different moments, according to the study groups. Londrina, 2000

Group	tpt assessment	Mean tpt - SR		Mean RH - SR	
		(ºC)	se	(%)	se
Control	Induction	24.7	1.60	53.2	10.46
	15'	24.1	1.42	52.2	10.85
	30'	23.5	1.17	48.3	8.71
	1h	23.0	1.18	42.6	5.33
Experimental I	Induction	25.3	1.47	51.7	8.62
	15'	24.5	1.60	49.7	9.62
	30'	23.4	1.61	46.5	10.92
	1h	22.5	1.24	40.7	5.47
Experimental II	Induction	25.4	1.35	54.3	9.49
	15'	24.6	1.10	53.3	10.10
	30'	23.4	1.02	47.5	6.83
	1h	22.9	1.28	41.5	2.95

Table 2 shows that the three groups were submitted to surgical procedures in SR environments that presented the same temperature and relative humidity pattern across the evaluations. There were no statistically significant differences between group means, with p = 0.679 for SR temperature and p = 0.514 for relative humidity. The analysis demonstrated, however, significant temperature and relative humidity alterations between different moments (p = 0.0001).

The values found in the study presented mean between 22.5 e 25.4ºC, which, according to several studies[1,11], are recommended as safe parameters.

Table 3 - Distribution of patients according to the incidence of hypothermia, Londrina, 2000

Hypothermia	CG		EG-I		EG-II		Total	
	(n)	(n%)	(n)	(n%)	(n)	(n%)	(n)	(n%)
Yes	15	55.5	16	59.2	17	62.9	48	59.3
No	12	44.4	11	40.7	10	37.0	33	40.7

P = 0.858

Table 3 demonstrates that there are no statistically significant differences between hypothermic and non-hypothermic patients from the three groups studied with p = 0.858. The incidence of hypothermia is in agreement with several studies[1-3,12], with an incidence level around 60%.

Table 4 - Distribution of body temperature means at different assessment moments according to the study groups, Londrina, 2000

Group	Moment of Evaluation	Mean tpt patient	
		Mean	se
Control	Induction	35.5	0.43
	15'	35.2	0.39
	30'	35.1	0.46
	1h	34.8	0.51
Experimental I	Induction	35.5	0.43
	15'	35.3	0.51
	30'	35.0	0.41
	1h	34.8	0.60
Experimental II	Induction	35.4	0.43
	15'	35.2	0.41
	30'	35.0	0.40
	1h	34.7	0.50

p = 0.709

Table 4 shows a temperature decrease in patients from the three groups, though it was not statistically significant (p = 0.709).

Several authors recommend warming the largest part of the exposed body surface, at least with blankets[1,7-9]. In this study, this intervention was performed in experimental group I, although it was not effective, but rather equal to the other groups regarding temperature variation during the first hour of anesthesia.

Several studies recommend passive cutaneous warming[1,9], but it is a fact that the active method is more effective than the passive. The latter has little impact in the first hour of the surgery due to the physiological redistribution of heat - the body transfers heat from the core to the periphery until it reaches the core temperature plateau[1-2,4,6,11].

The redistribution of heat in the organism could be reduced by increasing the temperature of the peripheral tissue before the anesthetic induction - pre warming -, for a period of one to two hours with active heat, in order to diminish the core-peripheral temperature gradient[4-5,10-11,13-14].

It is important to keep in mind that many routine procedures performed by the health team can interfere in the loss of body heat, such as the bath before surgery, exclusive use of surgical gowns, transport to the surgical center without the additional protection of a blanket. These factors and other intraoperative procedures are recognized by NANDA (North American Nursing Diagnosis Association) as signs for the diagnosis of Risk for Imbalanced Body Temperature[15].

Some patients had their ear temperature measured right when they entered the surgical room, with a mean of 35.6ºC (p = 0.475). This fact demonstrates that the patients arrived for surgery already with a decreasing temperature.

Some facts can explain why the interventions proposed in the present study did not present the expected results. The first is the gradient of the existent temperature between the central and peripheral compartments, which was already increased even at the beginning of the anesthetic-surgical procedure. With the increased gradient, the organism seeks to defend itself in order to achieve balance, for example: if there is vasodilatation, there is heat loss and, therefore, the gradient increases. Thus, an internal heat redistribution of the axis central-peripheral occurs, making the central temperature decrease and the peripheral one increase until it enters a plateau phase. This happens in order to maintain the metabolic heat for the central compartment.

The other fact is that the supply of heat to peripheral tissues is increased by the heat produced via tissue metabolism, which is decreased due to anesthetic drugs and hypothermia itself.

Finally, the blanket provides little warmth, since it is the layer of air between the blanket and the skin that keeps the heat. In this study, the patients already had a lower body temperature at the beginning of the procedure and under the effect of anesthetic drugs which hinders the production of heat by the body in order to maintain the layer of heat. Studies indicate that adding two blankets instead of one can diminish heat loss by about 20%, but never more than that.

CONCLUSION

This research allowed us to conclude that:

- Patients from the three study groups did not present statistically significant differences regarding body temperature variations in the first hour of the anesthetic-surgical procedure. It is appointed in this study that gender, surgery dimension, anti-septic agent used, type of anesthesia, infusion of warmed and non warmed liquids, body mass index, temperature and relative humidity of the surgical room and drugs used did not presented any interference in the results because the three groups were homogeneous regarding these variables.

The findings lead to the conclusion that other methods need to be associated when using passive warming, such as infusion and irrigation with warmed solutions, pre warming the patient and using blankets.

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