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Heating methods in the prevention of intraoperative hypothermia of elective abdominal surgery

Métodos de aquecimento na prevenção da hipotermia no intraoperatório de cirurgia abdominal eletiva

Métodos de calentamiento en la prevención de la hipotermia en el proceso intraoperatorio de una cirugía abdominal electiva

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Abstract

Objective: To identify heating methods to prevent intraoperative hypothermia in elective abdominal surgery with visceral exposure, in adult patients. **Methods:** Quantitative, exploratory, descriptive and prospective study performed in a public hospital, in southern Brazil. The sample consisted of 63 patients. It was possible to observe the heating methods used and measure the tympanic temperature. For data processing, it was used descriptive statistics through the SEstatNet software. **Results:** Active and passive heating methods were used. The infusion of heated fluids for abdominal cavity irrigation was the most used measure (nº 63; 100%) of the active process, while maintaining the cooling system off until the surgery beginning was the most used measurement (nº 57; 90.5%) of the passive method. **Conclusion:** There was no severe hypothermia with the heating methods utilized. However, there are more efficient current methods that could prevent mild and moderate hypothermia found.

Keywords: Hypothermia; Perioperative Nursing; Operating Room Nursing; Perioperative Period; Elective Surgical Procedures.

Resumo

Objetivo: Identificar os métodos de aquecimento para prevenir hipotermia em pacientes adultos no intraoperatório de cirurgia abdominal eletiva com exposição visceral. **Métodos:** Estudo quantitativo, exploratório e descritivo, prospectivo, realizado num hospital público da região sul do Brasil. Constituiu a amostra 63 pacientes. Observaram-se os métodos de aquecimento utilizados e foi aferida a temperatura timpânica. Para tratamento dos dados, aplicou-se a estatística descritiva por meio do *software* SEstatNet. **Resultados:** Foram utilizados métodos de aquecimento ativo e passivo. A infusão de fluidos aquecidos para irrigação da cavidade abdominal foi a medida mais empregada (nº 63; 100%) do método ativo, enquanto que a manutenção do sistema de refrigeração desligado até o início da cirurgia foi a medida mais utilizada (nº 57; 90,5%) do método passivo. **Conclusão:** Com os métodos de aquecimento empregados não houve hipotermia grave, porém, existem métodos atuais mais eficientes que poderiam prevenir a hipotermia leve e moderada encontradas.

Palavras-chave: Hipotermia; Enfermagem Perioperatória; Enfermagem de Centro Cirúrgico; Período Perioperatório; Procedimentos Cirúrgicos Eletivos.

Resumen

Objetivo: Identificar los métodos de calentamiento para prevención de la hipotermia en pacientes adultos en el intraoperatorio de cirugía abdominal electiva con exposición visceral. **Métodos:** Estudio cuantitativo, exploratorio, descriptivo y prospectivo realizado en un hospital público de la Región Sur de Brasil. Participaron 63 pacientes. Fueron observados los métodos de calentamiento y la temperatura timpánica. Para el tratamiento de los datos, se utilizó la estadística descriptiva a partir del *software* SEstatNet. **Resultados:** Se utilizaron métodos de calentamiento activo y pasivo. La infusión de fluidos calentados para la irrigación de la cavidad abdominal fue la medida activa más empleada (nº 63; 100%), mientras el mantenimiento del sistema de refrigeración apagado hasta el inicio de la cirugía fue la medida más utilizada (nº 57; 90,5%) del método pasivo. **Conclusión:** No hubo hipotermia grave con los métodos empleados, sin embargo, existen métodos actuales más eficientes que podrían prevenir hipotermias leves y moderadas encontradas.

Palabras clave: Hipotermia; Enfermería Perioperatoria; Enfermería de Quirófano; Periodo Perioperatorio; Procedimientos Quirúrgicos Electivos.

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INTRODUCTION

The diminishing of corporal temperature during surgery under 36°C characterizes an inter-operatorial hypothermia, a common problem usually little diagnosed because of monitoring of temperature being hardly conducted[1].

Interoperation hypothermia is related to various factors, anesthetic agents, temperature in the operating room, time of exposure to environments with low temperatures, cold venous infusions[2,3] and unheated irrigation fluids. Moreover, there exist factors of risk from the proper patient like extreme body weight[3], extreme age, metabolic diseases and neurological disturbances[2]. It is remarkable that patients submitted to surgeries that expose great body cavities open to environment air are more susceptible to hipothermia[3], like for instance, in conventional abdominal surgery.

Maintaining of the normothermia is an important aspect for the security of the patient to obtain positive chirurgical results and add to the patient's satisfaction[3]. In this sense it is remarkable that the nurses have to be aware of the implications of hypothermia for the patient submitted to the surgery as well as to identify those of risk in pre-operative evaluation as precaution measures may reduce the loss of heat and minimalize the risk of associated complications[4], inclusive cardiovascular events, infection of the chirurgical wounds and inter-operatory bleeding because of coagulation disturbances[5].

In clinical practice all involved professionals participate in assistance to the surgery patient and adoption of measures to prevent hypothermia. Besides being responsible for the planning and implementation of these measures, the nurse is linked to the taking of decision for the acquisition of materials and equipment related to this practice in health services[6].

There are more and more initiatives to promote the security of health assistance, but recent and innovative study directed towards patient's security is necessary, it is the participation of the nurse in the implementation of strategies to improve the quality and security of care in nursing[7].

Means of heating to prevent inter-operatory hypothermia and guarantee a secure care of quality exist, classified as passive and active, having distinct effectiveness. Up to the turn of the year 1990, passive heating measures were the only ones existing until the active measures emerged[8].

Included as passive heating measures are the cotton cover[5,8], cotton sheets, winding the inferior body parts with orthopedic cotton and crepe binding[9], adjusting the temperature in the operating room[10]. Among the actives measures is an electric radiation system with an fiber carbon electric cover; transfer of energy with adhesive apparatus/forced heated air, headed wear circulation, heated water matrass[6]; irrigation with heated fluids[11,12] and venous infusion with heated fluid[13-16].

It is considered important to know the heating methods that are being used in pracice to avoid intersurgical hypothermia and guarantee a secure assistance of quality, this research has as guiding questing: what are the heating methods used in the prevention of hypothermia in adult patients during operation of abdominal surgery com visceral exposure, in a hospital in the Southern region of Brazil? To this end, the study had as objective the identification of heating methods to prevent hypothermia in adult patients during operation of abdominal surgery com visceral exposure.

This investigation is expected to be relevant in the production of knowledge on intersurgical hypothermia and care for its prevention, since this theme still is little researched by the scientific community and especially by national nursing.

METHODS

This is a study with quantitative alignment, non-experimental, prospective explorative and descriptive. The study was realized between august and November of 2013 in the chirurgic center of a public university hospital, reference for complex surgery of medium and large scale situated in the southern region of Brazil. The article is a clipping of the master dissertation under the title "Evaluation of Unplanned Hypothermia during Operation of Abdominal Surgery.

The research population consisted of 263 patients submitted to abdominal elective surgery with visceral exposure. The sample consisted of 63 patients meeting the criteria for inclusion. The sample size was determined using a 5% significance level and testing power of 90% having as a based the standard deviation of previous research. Sampling was of the sequential non-probabilistic kind.

Inclusion criteria defining the sample were: age between 18 and 59 years, of both sexes, surgery time at least 120 minutes, Corporal Mass Index (CMI) equal or inferior to 35 kg/m^2 ad classification in the *American Society of Anesthesiologists* (ASA) I, II, e III. Excluded were 200 patients due to: age over 60 years (88) and morbid obesity (110) and ASA IV (2).

In relation to CMI the we used the OMS classification[17]: Obesity I (30 to 34.99 kg/m^2; Obesity II, considered severe (35 to 39.99 kg/m^2; and, Morbid Obesity (IMC ↑ 40 kg/m^2.

For the recruiting of the subject we verified on a daily basis the relation of the patients to be submitted, on the day following the abdominal elective surgery with visceral exposure., One of the researchers visited the patients in the submission unit to collect information on the comorbidities and realized the physical evaluation of the subject, as to guarantee his participation, respecting the inclusion criteria. All data were registered in proper instruments. O the day of surgery the patients were received by the same researcher who accompanied them during intersurgical period and who collected all data for the study.

To reach the proposed objective we elaborate an instrument that was submitted to apparent validation (clearness/understanding) and of content (relevancy) by three experts: a nurse, an anesthetist and a surgeon. They suggested the addition of anesthetical medication uses, nursing diagnostics and temperature of recuperation room, however, these were not honored for not being related to the objectives of the study. Consequently we realized a pre-test with five patients that were not part of the sample, finding no need for adequations of the elaborated instrument.

The instrument contemplated data related to the patient on anesthetical and chirurgical proceeding, to the operating room and to the implementation of heating methods. Data related to the participant's characteristics were extracted from the records and other data during the pre-surgery observation.

Measuring of the tympanic temperature of the patients as well as the temperature and humidity in the operating room were carried out at intervals of 15 and 30 minutes during the first and second hour respectively, In the period of 120 minutes six tympanic temperature checks were performed in each patient with intervals of 15 and 30 minutes in the first and second hour. These measurements were preceded by two further measuring events on entering the operation room (zero time) and immediately after the induction of anesthesia.

The temperature was checked with one and the same tympanic thermometer of the brand Adtemp® TM 421. Verification of temperature and humidity of the operating rooms was conducted with a thermos-hygrometer, mark More Fitness® positioned at the wall at a distance of 130 cm from the patient.

For the classification of the hypothermia we used the parameters used in literature[2]: mild hypothermia, temperature between 35°C and 35.9°C, moderate hypothermia, between 34°C and 34.9°C and severe hypothermia, ≤ a 33.9°C.

The data were organized in a database of the Microsoft Office Excel software, version 1 5.0.44 (2013) and analyzed with simple descriptive statistics through the SEstatNet[18] software.

The research project was approved by the Ethics in Research Committee (ERC) of the Santa Catarina Federal University, (Review nº 374.659/2013), conforming Resolution nº 466/12 of the National Health Council[19]. The Terms of Free and Clarified Consent was signed by the subjects of this research.

RESULTS

Sixty-three patients (100%) participated in the research of which 28 (44.4%) realized surgery of the digestive apparatus; 28 (44.4%), of the reproduction apparatus; 3 (4.8%), of the urinary apparatus; 2 (3.2%), chirurgical stages; 1 (1.6%), laparotomy; and 1 (1.6%), bypass of the aorta. Average age was 45.4 years (± 9.3) with predomination of female sex (nº 44; 69.8%). In relation to CMI, medium was of 26.9 Kg/m^2, be it that in 44 (69.8%) patients this index proved less than 30 Kg/m^2 and, in 19 (30.2%), between 30 and 34.99 Kg/m^2.

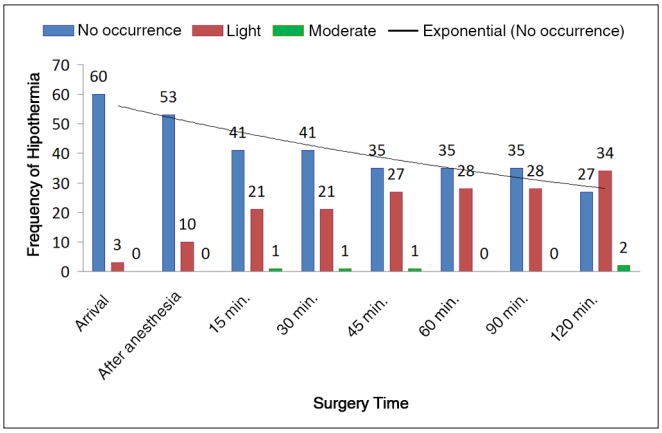
As to ASA, 6 (9.5%) patients were classified as ASA I, 45 (71.4%) as ASA II and 12 (19.1%) as ASA III. Prevailing anesthesia type was general associated with the peri-dural, realized in 38 (60.3%) patients, followed by isolated general anesthesia in 16 (25.4%), and spinal anesthesia in 9 (14.3%) interventions. Wirth registering is the medium temperature of the operation room during this research varied between 22.2°C (± 1.8), in the 90 to 120 minutes of surgery, to 23.1°C (± 1.9), in the interoperating 15 minutes. Referring to medium humidity in the rooms, the variation was between 54.2% (± 4.7) and 58.4% (± 6.27), identified at 120 minutes and after induction of anesthetics.

Medium tympanic temperature of the patients on admission to the operating room and on finalizing he chirurgical proceedings was between 36.5°C and 35.9°C.

Inter-operation hyperthermia

To evaluate the hypothermia during inter-operation, a total of 504 temperature measurements were realized. Figure 1 identifies the number of patients with hypothermia at different times during operation.

Figure 1. Variation of body temperature of patients during chirurgical proceedings. Southern Region of Brazil, 2013. Source: research data, 2013.



The occurrence of hypothermia during chirurgical proceedings reveals some constant intervals, but, in general there is a tendency towards augmenting of the number of cases. There was no hypothermia in 60 (95.2%) patients at arrival in the operating room, diminishing the number of cases, 35 (55.6%) non hypothermic's in the first hour reaching 27 (42.9%) at the end of the second hour. The number of patients with soft hypothermia augmented considerably during de surgery, passing from 3 (4.8%) at entering the operation room to 34 (54%) by the end of the second hour.

Heating Methods

Table 1 shows that 63 patients (100%) received active heating, associated with at least one method of passive heating on 57 (90.5%) cases.

The active method used in 63 patients composing the sample was infusion with heated fluids for the irrigation of the chirurgical cavity. (nº 63; 100%), followed by heating of the fluids for venous therapy, used in 61 (96.8%) cases.

It is suited to inform that in this study there were no measurement of temperature and volume of the fluids used for the irrigation of the abdominal cavity and neither of the fluids used for intravenous infusion.

Noteworthy is the fact that one or more passive heating measures were used on all of the investigated patients, yet none was applied on 634 participants. the most used method of passive heating(nº 57; 90.5%) was maintaining the cooling system off until the beginning of surgery, followed by the protection of inferior body parts with orthopedic cotton, crepe bindings or stockings (nº 56; 88.9%).

Table 1. Active and passive heating measures used in the prevention of hypothermia in the interoperation of elective abdominal surgery with visceral exposure. Southern Region of Brazil, 2013

Heating sistems	N	%
Measures of Passive Heating		
Refrigerating system off until start of surgery.	57	90.5
Protection of inferior body parts with orthopedic cotton and crepe bindings	56	88.9
Protection with matrass, sheets, covers in the area of thorax and shoulder, ad afterwards, colocation of chirurgical fields.	31	50.8
Active Heating Measurements		
Heated irrigation of the abdominal caving	63	100
Heated fluids for venous therapy	61	96.8
Forced heating by warm air	32	50.8

Source: research data, 2013.

It is worth to register the medium temperature of the patients at the end of chirurgical proceedings conform to the used heating type. In patients that used the active heating method associated with at least one passive method, medium temperature was from 35.9°C and of 36.0°C when the heating of infusion fluid was used (irrigation and/or venous therapy) or heating forced by hot air respectively. Thus the data appoint no difference in medium temperatures when comparing used methods.

DISCUSSION

There was a gradual augmentation in the number of hypothermal patients in the course of the chirurgical proceedings, being greater as 120 minutes interoperating, considering those with mild (nº 34; 54%) and moderate (nº 2; 3.1%) hypothermia as shown in Figure 1. This figure proves also that at the last measurement of temperature, being the one at 120 minutes, the number of hypothermal patients was larger than the non-hypothermal ones. This reinsures the need for temperature monitoring during surgery as adequation of preventive measurements during the whole interoperation course, conform the alterations presented by the patient.

As a whole, the findings reveal that the largest incidence of hypothermia, observed at 120 minutes is similar to that found in another study[20], evolved in a hospital in Londrina, Paraná, where the incidence found was around 60% (nº 48; 59.3%), considering aged patients of control groups (CG) and experimental ones (EG I and II).

In relation to the severeness of the hypothermia the results of this study were better when compared to those from an investigation[2] realized in a hospital in Santos, São Paulo where it was identified that, although all patients presented normothermical on entering the operation room, at exit 22 (73.3%) of them presented mild hypothermia, with temperatures between 35.1°C to 35.9°C and 7 (23.4%) moderate hypothermia with temperatures below 35°C.

Research[21] realized with patients submitted to elective abdominal surgery of large scale identified that under surgery medium final temperature was at least 36°C for all investigated groups although these patients had special risks of hypothermia due to type, scale of surgery (open abdominal surgery of large scale) end anesthetical proceedings (combined peridural and general analgesia).

This study compared the effectiveness of a piece of clothing with heated water circulating and thermical matrass with systems of heating by forced air and fibercarbon. Observe that the investigation inly used classified measure as active methods[21] and of these only heating by forced air was used in this study where the same medium temperatures (36°C) was evidences a the end of the chirurgical proceedings when used he heating by forced air combined with at least one passive method.

Study corroborates that the risk of hypothermia is especially high in patients submitted to large scale or prolonged surgery[22]. The largest loss of heat occurs in the first hour of the chirurgical proceedings, where patients under general anesthesia can reach 1.5°C[1].

In spite of literature pointing he loss of temperature in the first 60 minutes of surgery, during this study there was no sever hypothermia during the time of evaluated surgery (120 minutes) and, in the total of realized surgeries, moderate hypothermia occurred only three times within the first 60 minutes. This low frequency of hypothermia of some magnitude but significant may be considered positive and arouses even more the interest of understanding the measures used for the prevention of hypothermia under surgery of patients submitted to elective abdominal surgery as well as relating factors.

For the prevention of hypothermia under surgery of elective abdominal surgery with visceral exposure this study identified passive and active heating methods with a predominance of the active forms of eating. Six different measures were spotted, of which three classified as passive methods (cooling system remained off until begin of operation; protection of inferior body parts worth orthopedic cotton and crepe bindings; extra protection with matrass, sheets, covers in the regions of thorax and shoulders, and afterwards colocation of chirurgical fields) and three as active (heated fluids for irrigation of the abdominal cavity; heated fluids for venous therapy and heating by forced air).

Of the measures identified in this study four (cover, wrapping of the body parts with orthopedic cotton and crepe bindings, heated venous infusion and heated forced air) were also analized in another research with patients during inter surgery,. In referred research passive measures were not used whereas the active ones, heated venous infusion and heated forced air were used in 12 (40%) and 6 (20%) patients respectively[2].

In relation to the passive heating measures revealed in this study, similar research was performed on adult patients in inter surgery of elective surgery demonstrating that of 70 of the

participants merely 18 used some passive cutaneous heating measure, of which 8 (11.4%) were heated with cotton sheets and 10 (14.3%) with wrappings of the inferior body parts using orthopedic cotton and crepe bindings. No other form of passive heating was registered[9].

Differently, this study identified a larger quantity of patients receiving passive cutaneous heating measures: sheets, matrasses and covers in the regions of torax and shoulders, followed by collocations of chirurgical fields (nº 31; 50.8%); orthopedic cotton and crepe bindings (nº 56; 88.9%); besides this, the cooling system was maintained off until beginning of surgery om 57 patients (90.5%) a measure to be considerd as lower roo temperatures also add to the risk of hypothermia[22].

Investigation realized with elderly in a hospital in Paraná showed that inter surgical body temperature variance of the patients did not suffer influence from temperature and humidity of the environment that maintained media between 22.5°C and 25.4°C and 40.7% and 54.3%, respectively[20]. Other research in a municipality of São Paulo does not corroborate these findings as the operating room temperature may have contributed to the hypothermia in 43.3% of the patients.

Literature suggest that passive heating measures are not efficient in the maintaining of the temperature in the perioperatory[23], since they merely reduce the loss of heat, different from those qualified as active methods, that may inhibit loss of heat or even permit offering it to the body[16].

Thus, for the prevention of hypothermia recommended are: for active methods to be uses in surgery of more than 30 minutes, heating is to be applied before induction of anesthetics and, in long chirurgical proceedings and in patients with high risk, the loss of heat should be avoided with more than an active measure[16].

The results prove that all of the patients (nº 63; 100%) submitted to elective abdominal surgery with visceral exposure received a least one method of active heating. Also in the national settings, contrary to this research, study with adult patients of elective surgery revealed that of the 70 participants only 18.5% (nº 13) used some measure of active heating during operation[9].

Among the active heating methods used with patients to prevent hypothermia, the system of forced heated air was the less used (nº 32; 50.8%), as it was in another investigation whose heating system was applied in only one patient (1.4%)[9].

In international context a survey realized in Europe involving 801 hospitals in 17 countries concluded that the monitoring of temperature during operation is rare and active heating of the patient is not standard in European attendance. In general, less than half (38.5%) of the patients was actively heated, the heating with forced air being the measure of coice for the patients under general and local anesthesia[24], a different aspect of this study which heating measure was only used (50.8%) although proportionally its application was superior to that of the European hospitals.

It is necessary to consider the limited application of active heating technology in the prevention of hypothermia due to the financial investment needed. Although the superiority od active measures like forced air heating is recognized, the costs and disposal of them are also subjected in a study on the application of plastic polyethylene bags of low density, and alternative and cheap method of preventing perioperative hypothermia, especially in areas which limited economic resources.

Altogether, attention is drawn to the risks-benefits relation as the costs involving prevention of hypothermia under surgery is less when compared to those of the treatment of adversary results, like the need of blood transfusions originating from hypothermia of a surgery patient[9].

Systematic revision analyzing 23 clinical essays testing different active cutaneous heating measures in comparison with the system of forced heated air, concluded that there is evidence indicating the system f circulating heated water as the most effective in maintaining body heat, although systems of forded heated air and the one employing carbon fiber technology have a similar effectiveness[6].

Research realized with patients submitted to open gastrointestinal surgery that compared thermic matrasses to the forced heated air system showed that the first is more effective in the prevention of inter and post operatory hypothermia.

Meanwhile, as shown in the systematic revision, it is necessary to interpret the results with care, since the methodological quality of the analyzed studies was considered to be moderate[6]. Observe as well that this revision did not analyze comparative studies using the systems of fluid heating (for irrigation of the abdominal cavity and for venous therapy), and the system of forced heated air, it should be relevant to understand as the first were used with a higher frequency in this study, be it associated with some passive method.

Research trying to verify the effectiveness of heated venous infusion for the prevention of hypothermia in inter operatory patients concluded that its use by itself does not prevent this thermic manifestation, as control and experimental groups exited the surgery with temperatures below 36°C. Thus we alert to the prevention of hypothermia heating measures have to be applied to the patient before operation and temperature control in the surgery environment. Considering that in this study almost all patients received heated venous infusion (nº 61; 96.8%) and that the cooling system was maintained off until beginning of surgery in 57 (90.5%) cases, the association between active and passive methods, recommended by the authors[13] may benefit patients in the prevention of hypothermia, an aspect that was no object of this study.

The study object was to evaluate temperature control during surgery, determine the frequency of hypothermia and related factors showing that monitoring of temperature took place with 10% of the patients. The use of intravenous heated fluids and heated forced air was applied in 78% and 63% of the patients respectivelye[14] other than in this investigation that identified a higher frequency (96.8%) in the administration of heated fluids and lover (50.8%) in the use of forced heated air comparatively.

In this research mention was of irrigation with heated fluids as heating measure, used i the inter surgery in all the patients (nº 63; 100%) submitted to elective abdominal surgery with

visceral exposure, but we need to mention this measure always to be employed associated with at least one passive methods, which draws attention if considering that no hypothermia did occur in 327 (64.9%) of the temperature measuring, fortifying the relevancy of the supporting application of active and passive heating measures.

In relation to the irrigation with heated fluid, other studies[11,12] show that this measure demonstrates positive results in corporal temperature, reducing the risk of hypothermia for the surgery patient.

Systematic revision that included 13 randomized clinical essays with 686 patients evidenced that irrigation with fluids at ambient temperature provoked major reduction of central body temperature compared with the irrigation using heated fluid. It was concluded that in endoscopic surgery the irrigation fluid has to be heated to diminish a fall in the temperature and the risk of hypothermia, a relevant aspect in clinical practice. Thus, heating irrigation fluid should be considered practice in all endoscopic surgery[11].

Randomized clinical essays with men between 50 and 85 years of age that died to compare the alteration of temperature using heated irrigation fluids and fluids on ambient temperature in surgery with trans-ureteral resection of the prostate under spinal anesthesia, showed that the fall in temperature with patients receiving irrigation with heated fluid was minor (0.8°C) than in those submitted to irrigation with fluids on ambient temperature (2.38°C) being a statistically significant difference. It was concluded that the use of heated irrigation fluids reduces the risk of hypothermia[12].

The findings shown that the use of heating methods during elective abdominal surgery with visceral exposure is a routine practice in the institute of study through ten employment od active and passive hypothermia preventing systems, suggesting a preoccupation with maintaining body temperature during surgery not always observed in other Brazilian settings, even in relation to passive method, considered to be low-cost. This might be related to unsatisfactory results pointed out in literature[16] for the isolated use of this method, that is, ot associated with an active method.

We believe in the growing tendency of routine application of various heating measures to prevent hypothermia during surgery, as their use does not take time, is not problematic and in most of the cases is also not excessively expensive[16].

Routine implementation of active and passive heating methods showed to be a viable practice during elective abdominal surgery with visceral exposure in the reality of a public hospital in the southern region of Brazil, with place for the active measures for the prevention of hypothermia since its clinical application in surgery patients presents more efficient results, seeing the literature.

CONCLUSION

Reporting to the objectives of the study, the surgery center where research took place adopted three active heating measures, being irrigation with heated fluid applied to all patients. As passive method also three heating measures were identified, especially the system of maintaining cooling systems off until beginning of surgery, although not applied for all subjects.

It was observed that there was a gradual fall of temperature during surgery, especially during the first hour of surgery proceedings, even with the use of heating methods. It can be said that that was no occurrence of severe hypothermia that is below or equal to 33.9%, due to the employment of heating methods with all 63 participating patients of this study.

In spite of the positive results in relation with the prevention of hypothermia, especially moderate and severe, with the implementation of heating methods identified in the research, it was seen that use of these is still very much empirical as there is no standardization of practices. Besides that, more efficient actual methods exist that can be used in health service. In this sense, it is considered important for managers and the surgery team and especially the nursing professionals, to understand the technologies and their benefits, aiming to incorporate them in the institutions and guarantee the patient's security.

We suggest new studies to analyze the association between heating methods with as variables patient characteristics, operating room conditions and temperature of heated fluids and the temperature variation displayed by the participants.

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