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Hypothermia Effects Observed Under Anesthesia: An Integrative Literature Review

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Authors' contributions

This work was carried out in collaboration among all authors. Authors FS and LLB designed the research. Authors FS, LLB, VHA, GHMTB, GPB, TAPD, and DS wrote the manuscript. All authors contributed to the article and approved the submitted version.

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Review Article

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ABSTRACT

Of the regular temperature of approximately 37°C, about 0.8°C are dedicated to the internal maintenance of the brain, heart and organs located in the abdomen, being said of the central temperature, with the aim of avoiding large variations in temperature, in order to favour the functions of the vital systems. When the central temperature drops to less than 36°C, then

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hypothermia occurs.The studies suggest the control and monitoring of the patient's temperature during surgery, and point out strategies for the maintenance of the temperature and loss of heat in the patient, from preheating with varying duration thermal blanket and heating of intravenous fluids.Thinking about this, the objective of this review was to provide comprehensive information about the effects of perioperative hypothermia and its risks and consequences in patients undergoing the anesthetic act within and outside the surgical block, from the study of the current available literature.The research led to ten publications, mostly listed with level I evidence (5); in other level II articles (2); only one level III article and fourth level articles. All the papers explored the control, monitoring, consequences and risks of perioperative hypothermia. Concluding that continuing education, training, building skills to implement the current hypothermia management guidelines and institutional support are fundamental aspects inining episodes of perioperative hypothermie.

Keywords: Perioperative hypothermia; thermoregulation; anesthesia; physiological effects.

1. INTRODUCTION

The normal body temperature is approximately 37°C and its strict control is important forining the normal functions of cells, enzymes and organs [14]. Within this range, the central body temperature varies to maintain many ideal physiological processes throughout the human body, including metabolic changes [32,33], sleep/wake cycles [8], hormonal cycles [1], immunity [10], metabolic dysfunction [37] and among others [34].

In cases where the central body temperature is raised, the response to thermal stress activates the cholinergic vasodilator system, leading to a more substantial increase in the blood flow of the skin [46,47]. On the other hand, during exposure to cold, the adrenergic vasoconstrictor system becomes more active, reducing blood flow from the skin, thereby reducing the transfer of heat from the center to the periphery [1].

Several factors contribute to the development of perioperative hypothermia, in part by the administration of anesthesia, since the body's capacity for thermal regulation is impaired due to an approximately 20% decrease in metabolic heat production [20,22]. Patients who have a low central temperature before entering the surgery room are more likely to remain hypothermic during and after the surgical procedure [27].

Anesthesia-induced hypothermia is associated with a number of significant health-related problems, including increased infection at the surgical site [6], increased bleeding [15], increased stay in the post-anesthetic recovery unit which takes longer hospitalizations and increased pain [17,26]. With this in mind, the aim of this review was to provide comprehensive information on the effects of perioperative hypothermia and its risks and consequences in patients undergoing the anesthetic act inside and outside the surgical block, from the study of the current available literature.

1.1 Physiological Effects of Thermoregulation and Hypothermia

The normal body temperature is approximately 37°C, about 0.8°C is reserved to maintain the central temperature, which is intended to preserve stable conditions for the brain, heart and abdominal organs [39]. This is crucial to prevent significant temperature fluctuations and thus optimize the performance of vital systems [16].

Thermoregulation begins with the entry of anatomically distinct heat and cold sensors, found both peripherally in the skin and deep tissues, and centrally, in the spinal cord, brain trunk and hypothalamus [30], following a process consisting of three stages: afferent stimulation, central regulation and eferent response [39]. This process is sensitive to metabolic activity and responds differently to peripheral temperature. Signals originating in heat-sensitive cells present in the skin, muscles, spinal cord and other parts of the body trigger self-regulation mechanisms, such as sweating, vasoconstriction and vasodilatation, with the aim of adjusting thermal exchanges with the environment and preserving the central temperature [40].

In warm environments, the hypothalamus is activated, stimulating the release of mediators that promote vasodilation [40]. This can result in an increase in the heart rate, favouring a greater surface permeability, allowing the blood to carry out the heat exchange with the periphery of the body, mainly through the dissipation of heat by convection and radiation [25,26]. If these mechanisms are not sufficient to cool the body, the sweat process is triggered, which facilitates thermal exchange by evaporating sweat [3,4].

In contrast, in cold environments, the hypothalamus coordinates the release of mediators that promote vasoconstriction, restricting blood flow in areas of vital function, in order to prevent the decrease of central temperature [1]. If this measure is not enough, the body begins muscle tremors, and in particular, in children, there is an increase in heat production in brown fat tissue, which accelerates muscle metabolism, resulting in additional internal heat generation. Ultimately, thermal comfort isined through a balance between metabolic heat production and heat exchange with the environment [3].

When the central temperature drops to less than 36°C, then hypothermia occurs [17]. Even with the activation of the aforementioned compensatory systems, thermoregulation, although it is a strict function, proves to be inadequate in 50 to 90% of surgeries, leading to perioperative hypothermia [7,20]. Hypothermia can be classified as mild (34°C–36°C), moderate (30°C—34°C) or severe (<30°C) [3,9].

Autonomous thermoregulation is consistently affected when any anesthetic is used, due to changes in thresholds of heat and cold response, this results in an increase in vasodilation and a reduction in vasoconstriction [22]. Thresholds of sensation of cold and heat are modified in anesthetized individuals, with a significantly greater variation than observed in unanesthetised individuals. While the temperature variation of the sensation thresholds in unanesthetized subjects is about 0.2°C to 0.4°C, in anesthetised patients this variation can reach approximately 2 °C to 4°C [3,22].

Perioperative hypothermia (HP) is defined as the fall of the central temperature to less than 36 °C, and can cause systemic responses, among them, impaired pharmacodynamics, infections of the surgical site, blood loss and coagulopathy, thermal discomfort, prolonged duration of hospitalization [20,22,31].

Hypothermia during general anesthesia can be described as an event consisting of three phases, related to anesthetic-induced vasodilation and inhibition of thermoregulatory vasoconstriction. In the first phase, a sharp drop in the patient's central temperature occurs about an hour after the anesthetic induction, culminating in a reduction in the central temperature. The second phase is characterized by sharp heat loss due to low metabolic production, and begins approximately an hour after the anesthetic induction, similar to the first phase. Finally, the third phase marks the temperature balance, when the peripheral vasoconstriction threshold and the central temperature stabilize, limiting heat loss and keeping the body temperature constant [22,31].

It is important to mention that autonomous thermoregulation includes the phenomenon of muscle tremors, which is characterized by an involuntary and rhythmic somatic response of skeletal muscles. Its main purpose is to generate heat to help restore body temperature to normotermia. During the surgical procedure, muscle tremors may be less frequent, as muscle relaxants tend to reduce it. However, patients who experience severe hypothermia may still experience muscle tremors. Already in the postoperative period, muscle tremors are more common, although they should be avoided, as they can cause discomfort to the patient. In anesthesia, this tremor can be effectively treated with certain medications, such as ketamine [20,31].

Finally, it is important to consider the risk factors for perioperative hypothermia, with emphasis on the following: the age of the patient, with children and elderly people being more susceptible to unexpected episodes of hypothermia; low body mass index; patients who have been victims of burns, sepsis and trauma; the temperature in the surgery room; the duration of the surgical procedure; the anaesthetic technique used; and systolic pressure below 140 mmHg during the preoperative period. These presented factors may influence the occurrence of episodes of hypothermia, but do not consider them as imperative causes of these episodes [7,20].

1.2 Physiological Effects of Anesthesia and Hypothermia

The direct effect of the inhibition of thermoregulation due to the use of anesthetics results from the decrease in drug-induced metabolism, together with the patient's exposure to the cold environment of the surgical block. This leads to a reduction in metabolic heat production by approximately 20%. The combination of these factors can contribute to perioperative hypothermia [3,29].

In fact, the enzyme activity is sensitive to temperature, and therefore episodes of hypothermia can affect the metabolism of the anesthetics and have an impact on post-surgical effects, such as the time of stay in the post-anesthetic recovery room (PAR) [9.22]. A notable example is propofol, widely used in anesthesia, whose plasma concentration increases by approximately 28% when the central temperature drops to 3°C due to reduced hepatic blood flow [44,45]. Volatile anesthetics such as propofol and older opioids such as morphine and meperidine promote heat loss through vasodilation. This process is further aggravated by the fact that these drugs, as well as fentanyl and its derivatives, directly impair the hypothalamic thermoregulation in a dose-dependent form [13].

Fentanyl, another widely used anesthetic, also experiences an increase in its plasma concentration of about 5% when the central temperature drops 1°C. These variations in the concentration of anesthetics may affect the effectiveness of the anesthesia and the patient's post-surgical recovery. Therefore, proper temperature control during surgical procedures is crucial to optimizing results and patient safety [31].

The pharmacodynamic and physiological repercussions are undoubtedly one of the most prominent events in episodes of hypothermia in patients under anesthesia [5]. In relation to non-depolarizing muscle relaxants, hypothermia may prolong the time of action due to changes in distribution volume and changes in pH in the neuromuscular junction. For example, in cases of hypothermia, vecuronium has an approximately double duration compared to non-hypothermic patients. As for neostigmine, often used as a vecuronium antagonist, it appears to be unchanged, at least in cases of mild hypothermia. These changes in drug pharmacodynamics can affect anesthetic handling and post-surgical recovery and highlight the importance of body temperature control during anesthesia procedures [3,7,31].

It is interesting to note that atrophy presents a significant prolongation of its action in hypothermic patients, with an increase of 60% when there is a drop of 3°C in the central temperature. However, in the case of rocuronium, the authors mention an extension of its action, but do not specify other conditions besides hypothermia, such as the exact magnitude of this increase or the temperature range in which this effect is observed. This information highlights the complexity of the pharmacodynamics of muscle relaxants in hypothermic patients and the importance of careful temperature control during anesthetic procedures [3,31].

The potency of the anesthetics is influenced by partial pressure in the stationary state of the plasma, which is different from the actual concentration of the anaesthetic in the cells. Hypothermia tends to increase the solubility of volatile anesthetics, although apparently it does not affect their potency. However, hypothermia has a positive effect when it comes to volatile anesthetics, as it reduces the minimum alveolar concentration (CAM) needed to prevent a patient's response during surgical stimuli. The CAM of halotane and isoflurane decreases approximately 5% for each 1°C reduction at the central temperature. In children, isoflurane CAM decreases by approximately 5.1% for every 1°C reduction at central temperature. This means that, in hypothermic patients, a smaller amount of volatile anesthetic is needed to maintain effective anesthesia during the surgical procedure, which can be beneficial in terms of safety and cost [3,31].

Finally, it is important to note that during episodes of hypothermia, the secretion of corticosteroids is usuallyined, but in situations of prolonged episodes, the production of some hormones, such as thyroid-stimulating hormone (TSH) and insulin, may be suppressed [3,34].

1.3 Consequences of Perioperative and Postoperative Hypothermia

Perioperative hypothermia can impact various organ systems and have significant implications in the patient's clinical course, among them may be the alteration of the pharmacokinetics of drugs used for anesthesia [31], increased blood loss [2], coagulopathy [42], increased need for transfusion [38] and increased infections in patients undergoing cholecystectomy [21]. Other more notable risks can be visualized in Table 1.

Table 1. Risks and consequences of hypothermia on anesthesia [3,40]

Groups/Effects	Complications/Risks
Coagulopathies	Threatened platelet aggregation Increased blood loss
Increased risk of infection	Arrhythmias Myocardial ischemia Release of catecolamines
Changes in plasma solute concentration	Hypokalemia Hypomagnesemia Hypofosfatemia
Pharmacokinetics	Decreased elimination (muscle relaxant, volatile anesthetic, opiate anesthesic and β-adrenoceptor agonists).
Cardiovascular	Hypotension Bradicardia Arrhythmias Myocardial ischemia Release of catecolamines Deep venous thrombosis ECG changes (prolongamento QTc, prolongamento do intervalo PR, prolongamento QRS).
Endocrine and metabolic changes	Decrease in corticosteroids Decrease in insulin Decrease in peripheral insulin resistance Increased TSH and thyroxine Hyperglycaemia
Rebound hyperthermia	Tremor Cold-induced diuresis
Increased plasma concentration of propofol	Decrease of the minimum alveolar concentration 5% /1oC temperature.
Increased cardiotoxicity of bupivacaine	Difficult monitoring of wrist oximetry

Hypothermia impairs enzymatic activity, which results in reduced and slowed down metabolism, leading to prolonged action of various drugs used to induce or maintain anesthesia [27]. HP affects the defence mechanisms of the body, favouring three ways, these being vasoconstriction in the postoperative, reduction of the activation of immunity and finally hypoxia of the tissue, impeding the healing and metabolism of proteins [31]. It has been shown that hypothermia induces mechanisms for increased risk of infection, including vasoconstriction, impaired tissue healing, and reduced immune cell function [40].

In addition, the coagulation cascade is damaged due to the alteration in the function of the various enzymes involved in the process of formation of clots [3,31]. As well as can also influence decreased platelet function, promoting marginalization of these cell fragments by increasing the hematocrit, changing its shape, decreasing the rate of blood flow and increasing expression of adhesion molecules [42]. Lastly, hyperthermia also represents increased risk in blood transfusion scenarios [38], in the same way that it can alter myocardial contractions and induce arrhythmias associated with trauma [15].

1.4 Thermal Discomfort, Stress and Anxiety During Hypothermia

The most apparent factor for hypothermia is the relatively cold environment in the surgical room, especially in those with laminar flow [12]. Patients often identify the postoperative cold feeling as the worst part of the hospital, sometimes even worse than surgical pain, and can generate unwanted psychological consequences in the patient [31]. In addition, it can cause fear of new anesthesia, or even trauma (phobias, anxiety, nervousness, dreams/ nightmares and depression) [19]. In addition to being stressful for patients, HP episodes can repercuse in increased blood pressure, heart rate and plasma concentrations of catecolamines [31].

Under normal circumstances, the body controls its temperature with a very strict tolerance, the core being 2°C-4°C warmer than the periphery [23,24]. During general anesthesia the central thermoregulation is affected by impeding peripheral vasoconstriction and thermogenesis mechanisms. After induction, a decrease of 1°C occurs in 30 minutes [38] and in the process of recovery from anesthesia there is the resumption of the physiological thermoregulatory responses, allowing tremors, triggered to compensate for the intraoperative flow of heat, increasing the central temperature through increased metabolic rate and oxygen consumption [3].

During regional anesthesia decreases the threshold of tremors and vasoconstriction below the level of blockage, and hypothermia occurs by the redistribution of colder peripheral blood to the nucleus, due to vasodilation induced by regional anaesthetic [30].

Hypothermic patients are affected by a wider range of physiological and pathological responses and dysfunctions [37]. Exposure to cold can also impair cognitive function, increase pain, aggravate thermal discomfort and contribute to fear and a general feeling of dissatisfaction [18].

2. METHODOLOGY

This is a descriptive study that uses the methodology of integrative review of literature (IRL), which aims to synthesize research related to a specific topic in a systematic, organized and comprehensive manner. For the preparation of this work, six stages have been completed:(1) Delimitation of the topic; (2) Search in the literature; (3) Data collection (selection of material appropriate to the objectives and theme of this study); (4) Evaluation of studies included in the integrative review/Analysis of results; (5) Interpretation and discussion of the results; (6) Presentation of IRL.

First, there was the choice of the research topic, with the aim of identifying the central question of the review: What findings from various evidence-based research about perioperative hypothermia make it possible to synthesize interventions to keep the body temperature within the normal range and reduce the risks and possible complications during the perioperatory period.

The criterion for inclusion of the articles was full availability in electronic format in national and international journals published from 2015. However, exceptions were made for articles prior to 2015 that still had a significant impact on the community, evidenced by their impact factor and substantial number of quotes.

In addition, documents issued by regulatory bodies dealing with issues related to patient safety and comfort in the context of the surgical block were incorporated.

Articles not related to the theme of the guiding question have been excluded from the construction of this manuscript. With this study, it is hoped to improve the understanding of the risks associated with hypothermia in patients undergoing anaesthetic procedures. At the same time, it aims to stimulate a reflection on the routine practices of anesthesiologists and the risks inherent to them, strengthening the context involving the execution of this function in a more conscious and safe way, both in the environment of the surgical block and outside it.

3. RESULTS AND DISCUSSION

After the re-read of each of the articles selected for the research, their main information was extracted and to facilitate the viewing and organization was used the adapted instrument [41]. Table 2 allows you to evaluate each article separately, in terms of its authors and year of publication, objectives, results and level of evidence, making it easier to view the articles included in the survey, in order to summarize the information in a brief way. The evidence levels of the study-related articles were classified using a data-level score, considering the effectiveness of the intervention on a scale from I to IV, according to the level of evidence [28,36].

Level I: Evidence from meta-analysis of multiple controlled and randomized clinical trials;
Level II: Evidence obtained from individual studies with experimental delineation;
Level III: Evidence of near-experimental studies;
Level IV: Evidence of descriptive or qualitative studies.

Table 2. The evidence levels of the study-related articles

Author/Year	Objective	Resulted	Evidence
Wang & Deng, 2023.	Review recent advances in perioperative body temperature management.	Perioperative hypothermia is associated with tremors, postoperative infection, increased intraoperative blood loss and infusion of fluids or hemoderivates, and delayed recovery after anesthesia.	Level IV
Simegn et al., 2021.	Develop a clear clinical practice protocol in the prevention and treatment of perioperative hypothermia for elective adult surgical patients.	After data collection, the quality assessment of the study was based on the level of evidence and WHO 2011 recommendation. The final recommendations are made by balancing the advantages and disadvantages of alternative management strategies for the perioperative management of hypothermia.	Level I
Campos et al, 2020.	Determine the incidence of post-operative hypothermia, as well as its impact in the postoperative period, in elderly patients.	Of a total of 235 patients, 26% were HP. There was no relationship between the incidence of hypothermia and the type of anesthesia, but HP patients were subjected to a higher anesthetic time (p=0.030). These patients were less fragile (p = 0.048) and developed more cardiac events (p=0.003).	Level III
Cunha et al, 2020.	To synthesize the publications on the subject of unintentional hypothermia, which allows the incorporation of evidence in clinical practice.	16 scientific papers were analyzed and the interventions used for the prevention of unplanned hypothermia were obtained, the evidence levels of the studies were identified based on the methodological reference adopted from scale I to VI and the classification and levels according to the ASPAN guidelines.	Level I
Ruetzler & Kurz, 2018.	Describe the physiological and pharmacological processes that modify and induce perioperative hypothermia.	Description of the risks and complications of perioperative hypothermia	Level I
Urits et al, 2019	Show the main perioperative considerations of therapeutic hypothermia, including risks, benefits, indications, methods and monitoring.	Therapeutic hypothermia is an integral intervention for the preservation of the target organ and neuronal function during surgery inducing ischemia and patient conditions.	Level I
Ribeiro et al, 2019.	Estimate incidence rates of surgical site infection and identify the independent effect of perioperative	The incidence rate of surgical site infection was 20.25% (n = 98). The fraction attributable to exposure to hypothermia was > 40%. A higher probability of developing surgical site	Level IV

Author/Year	Objective	Resulted	Evidence
	hypothermia on the incidence of this type of infection in patients undergoing abdominal surgery.	infection (relative risk = 1.89) was found in patients who experienced body temperatures.	
Matias et al, 2017.	Evaluate the effectiveness of a protocol that has as central measure the active preheating with forced hot air initiated 10 minutes before the anesthetic induction in the prevention of inadvertent perioperative hypothermia.	Included 33 patients. The average temperature was 36.3 ± 0.59 °C. 27 patients (81.8%) had normotermia. Five patients (15.2%) had mild hypothermia and one patient (3%) had moderate hypothermia. There was no statistically significant difference in the final central temperature in laparoscopic procedures (p = 0.378).	Level II
Lopes et al, 2015.	Identify, in the results of empirical research, the active heating systems that have proved most effective in the pre and intraoperative for the prevention of hypothermia in the perioperative.	30 articles were obtained and seven were selected for analysis.	Level I
Danczuk et al, 2015.	Identify heating methods to prevent hypothermia in adult patients in intraoperative elective abdominal surgery with visceral exposure.	Active and passive heating methods were used. The infusion of heated fluids for irrigation of the abdominal cavity was the most used measure (at 63; 100%) of the active method, while the maintenance of the cooling system off until the beginning of the surgery was the more common measure (57; 90,5%) of the passive method.	Level IV

Recent studies highlight the importance of perioperative hypothermia (HP) as a risk factor in surgical site infections. This is relevant becauseining normal body temperature is critical to patient safety during and after surgery, which improves care and safety, and reduces healthcare costs. The same authors continue to cite the patient's own risk factors, such as body weight, age, metabolic diseases and neurological disorders. Emphasizing that patients undergoing surgeries that expose large body cavities to ambient air are more susceptible to hypothermia, as in conventional abdominal surgery [7,11,29].

PH has been shown to be less common in more fragile elderly patients and in patients with physical limitations and lower preoperative quality of life [7]. In this study, elderly patients under PH had more frequent events such as acute coronary syndrome and auricular fibrillation.

In other research shows that inadvertent perioperative hypothermia is not only a phenomenon of reduced body temperature, but also an unwanted adverse event that can lead to compromised perioperatory outcomes, including uncomfortable tremors, infection, bleeding, delayed recovery and even adverse cardiovascular events [43].

Hypothermia is also associated with a decrease in cerebral blood flow. This observation has been explored as a therapeutic variant of hypothermia, proven to be effective in protecting organs such as the brain, heart and kidneys during various surgeries, as well as improving neurological outcomes after cardiac arrest, traumatic brain injuries, spinal cord lesions, stroke or acute liver failure [40]. These mechanisms were observed in Table 3.

Surgical site infections attributed to PH episodes revealed that if exposure could be avoided during the anesthetic-surgical procedure, more than 40% of surgical infection cases would be prevented [29]. In the perioperative period,ining the patient's normal body temperature is considered a preventive measure against infections of the surgical site [22]. In general, the authors' results confirmed the relevance of hypothermia as an independent risk factor for surgical site infections and allowed the identification of several associated factors, some susceptible to intervention.

In relation to PH monitoring, the active heating methods used in patients, the forced heated air system was the least used [11]. The same actor cites that in the international context, temperature monitoring during surgery is rare and that active patient heating is not the standard of European care. The same study also highlights the application of low-density polyethylene plastic bags, an alternative and economical method for PH prevention, especially for geographical areas with limited economic resources.

The literature shows the main methods of heating systems of surgical patients. In preoperative, the skin warming 30 minutes before anesthesia increases the central, peripheral and total body temperature. In the intraoperative, both the passive and the active heating can affect the patient’s skin temperature, while in the postoperative the active warming should continue until the temperature exceeds 36°C [35,36].

Other studies have shown that the body temperature of adult patients decreasing by about 0.25°C for each liter of fluid infused at room temperature or blood derivatives transfusion after cooling to 4°C7. The author, however, draws attention to the risk/benefit ratio, as the cost of preventing PH is lower than the treatment.

Other studies show that despite the use of active warming measures, the incidence of hypothermia remains high in some studies. Several factors can influence the effectiveness of active heating, including heating time, target temperature and heating location [43].

The 10-minute heating for the patient entering the surgical block fills the range of mandatory measures taken before the anesthetic induction, such as monitoring with electrocardiogram, pletismography, blood pressure measurements, preparation of medicines, material of approach of the airway, among others [22]. For the author, preheating is an effective economic measure, of relatively easy application, which does not require extraordinary resources or investments and has a very favourable cost-benefit ratio.

The literature has focused on the control of HP episodes, always assuming the success of this monitoring from a central temperature above 36°C at the end of surgeries. However, there were no authors suggesting an exact value for the optimal temperature at the end of the surgeries. This is mainly due to the great potential that episodes of hypothermia have to increase infections at the surgical site, the number of post-operative complications and hospitalization costs [9]. However, if PH is not treated, it results in many adverse effects on the patient [35].

Table 3. Benefits and mechanisms of action of therapeutic hypothermia [40]

Groups	Effect
Neurotransmitters	Reduces extra-cellular levels of glutamate and glycine.
Metabolism	It reduces the metabolic rate of brain blood flow and the consumption of oxygen and glucose.
Apoptosis	It inhibits apoptosis by decreasing the activity of caspase, increasing the expression of Bcl-2 and preventing mitochondrial dysfunction.
Free radicals	Reduces the formation of free radicals and decreases the consumption of endogenous antioxidants.
Collagen Integrity and Myocardial Function	Reduces the fragmentation of interstitial collagen and the use of myocardial energy during ischemia.

None of the works listed above (Table 2), and those that form the basis of the theoretical reference of this work examined the levels of satisfaction of patients or the unfavourable emotional effects of hypothermia on them. Hospital procedures may even ignore this issue, usually studies focus mainly on molecular and physiological concepts, which means that the treatment of an individual focuses only on functionality and not on integrity, meaning that psychological factors can be ignored during treatment [19].

4. CONCLUSION

Thermoregulation is a fundamental mechanism of homeostasis, acting to maintain the stability of the internal environment necessary for human survival and the preservation of optimal cell function. Despite being a common occurrence, perioperative hypothermia often lacks due attention in the provision of health care. Therefore, it is relevant that the management of the surgical centre develop effective strategies for the implementation of good practices aimed atining normotermia in patients undergoing surgery.

The pharmacological and clinical implications of hypothermia have a significant impact on morbidity and mortality rates, especially when considering rates of infection of the surgical wound, blood loss and coagulation disorders. Thus, it is essential that the maintenance of normotermia is constantly monitored and that the appropriate resources are employed in the health services, ensuring that patients undergoing anesthetic procedures lasting more than 30 minutes do not suffer unnecessary thermal discomfort.

The methods of active patient warming, even when carried out in a short period of only ten minutes, demonstrates effectiveness in the prevention of significant peri and post-operative complications, without causing delays in the preparations of the surgical room. In addition, such practices have a positive impact on patient satisfaction, relieving the burden on the healthcare system and meeting the expectations of patients undergoing anesthetic-surgical procedures, who wish to avoid any discomfort, including the disconfort caused by the cold.

Thus, continuing education, training, building skills to implement the current guidelines on hypothermia management and institutional support are fundamental aspects.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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