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Original Research Paper

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# PREWARMING IN PATIENTS UNDERGOING ELECTIVE NEUROSURGERY: CRITICALLY APPRAISED TOPIC

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## ABSTRACT

**Summary:**

**Clinical setting:** A 20-year-old patient with a diagnosis of glioma multiforme, will be taken to a scheduled craniotomy for resection of his tumor. No medical or surgical pathological history. On physical examination, a patient with normal vital signs, without neurological focus. His neoplasm was excised by craniotomy under general anesthesia, with warm-up for 30 minutes and active intraoperative warm-up, without complications. He was transferred to the ICU for neurological surveillance. Discharge 7 days after surgery without complications.

**Clinical problem:** In adults who will undergo programmed neurosurgery, does warm-up decrease in-hospital mortality?

**Objetives:** Perform a Critically Appraised Topic (CAT) to (I) analyze existing research related to warming in patients undergoing neurosurgery, and (II) apply the results to the clinical setting.

**Methods:** A systematic search was carried out in 3 databases in search of publications about the clinical problem in adults over 18 years of age.

**Results:** Three studies met the inclusion criteria. The evidence about the usefulness of warming in reducing episodes of hypothermia during the intraoperative period is highlighted, however, no study was found that evaluated the outcomes of warming in the postoperative period.

**Conclusion:** Warming up for at least 10 minutes is a useful measure to increase comfort and reduce hypothermic episodes. The prevention of hypothermic episodes during the perioperative period has been shown to be useful for reducing multiple complications including mortality. However, the usefulness of postoperative warming in neurosurgery is unknown, despite this its use is recommended due to its causal relationship with the decrease in perioperative hypothermia for at least a period of 10 minutes and to continue it even during induction.

## KEYWORDS :

### Clinical setting

A 20-year-old patient with a diagnosis of glioma multiforme, will be taken to a scheduled craniotomy for resection of his tumor. No medical or surgical pathological history. On physical examination, a patient with normal vital signs, without neurological focus. His neoplasm was excised by craniotomy under general anesthesia, with warm-up for 30 minutes and active intraoperative warm-up, without complications. He was transferred to the ICU for neurological surveillance. Discharge 7 days after surgery without complications.

It is known that active intraoperative warming and warming decrease the presentation of intraoperative hypothermia in patients undergoing neurosurgery, in addition the prevention of intraoperative hypothermia decreases in-hospital mortality, however, it is unknown whether prewarming is a measure that decreases in-hospital mortality in patients undergoing elective neurosurgery.

In adults who will undergo programmed neurosurgery, does warm-up decrease in-hospital mortality?

### Problem

Temperature is a vital sign whose normal value is between 36.5° C and 37.3° C, controlled by the hypothalamus, but factors such as anesthesia, age, alcohol and circadian rhythm affect the thresholds of physiological responses ( one). General and neuraxial anesthesia generate central temperature oscillations between 1° C and 3 °C, predisposing to hypothermia (2). Perioperative hypothermia (<36 ° C) is a common outcome, reaching an incidence of up to 90% (3), the main independent risk factors for its presentation are age OR 1.23 (95% CI 1.11-1 , 36), body mass index OR 1.83 (95% CI 1.43-2.35), duration of surgery OR 2.10 (95% CI 1.63-2.70) and anesthesia general combined with paravertebral block after induction OR 2.30 (95% CI 1.31-4.03) (4). The presentation of hypothermia in patients undergoing elective surgery has been associated with an increase in multiple complications such as infection of the operative site, sepsis, cerebrovascular accidents (26.3% vs 13.9%; p <0.001), and an increase of up to 4 times mortality (17% vs 4%; p <0.001) (5).

Prevention of perioperative hypothermia has been associated with a decrease in surgical site infection RR 0.26 (95% CI 0.12-0.58), blood transfusions RR 0.39 (95% CI 0.22 -0.68) and morbid cardiac events RR 0.34 (95% CI 0.20-0.57) with the hot air strategy (6), which has been shown to be the most effective strategy for reducing hypothermia perioperative with a difference compared to other strategies, such as circulating hot water, of at least 1.5 ° C (p <0.05); resulting in a decrease in overall hospitalization costs (7). Prewarming has been studied as a hypothermia prevention strategy, there is an association with an increase in core temperature of 0.42 ° C (95% CI, 0.27-0.57; p <0.001) (8) and Its application during spinal surgery reduces perioperative hypothermia (P <0.001) (9), but does not reduce hypotension or the need for vasopressors in neurosurgical patients (10). However, it is unknown whether its use reduces in-hospital mortality in patients who will undergo elective neurosurgery.

## METHODS

A systematic search was carried out following the four steps to carry out a critically evaluated topic described by Callander (11). The format of population, intervention, comparator and result was used to formulate a research question. The population consisted of adults who underwent neurosurgery, the intervention was to perform warm-up, the comparator being the placebo, as a result, in-hospital mortality was established.

### Research question formulation

The research question arose from clinical practice, under the PICO question format that involves a population, intervention, comparison, and outcome.

In adults who will undergo programmed neurosurgery, does warm-up decrease in-hospital mortality?

### Search for the best possible evidence

A search of publications was carried out in 3 databases: Medline, LILACS and Google Scohlar, without restriction of publication date, a total of 3 studies were identified after exclusion in duplicate and by the subject of the article that responded to the clinical problem. The strategy in Medline was carried out with Mesh thesauri (Suppl S1), while in LILACS it was carried out with Decs terms, and in Google Scholar a more open search was carried out to increase search sensitivity.

The criteria for inclusion were those studies whose title or abstract included warm-up and neurosurgery. Narrative reviews, case reports, and studies that did not address warm-up in patients undergoing neurosurgery were excluded.

Fulfilling the inclusion and exclusion criteria, 3 articles were reviewed in full text (Figure 1).

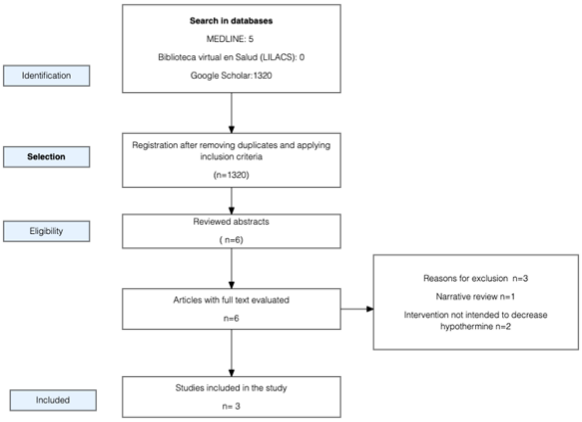


**Figure 1. PRISMA.**

### Critical appraisal of the evidence

All three studies were critically appraised using Critical Appraisal Skills Program (CASP). Two studies were experimental and one was pseudo-experimental. The scores of the two experimental studies were 9/10 and that of the pseudo-experimental study was 7/10 (Table 1).

**Table 1. Characteristics of the included studies.**

| Study | Objetive | Type of Study | Study participants | Key message | CASP |
|---|---|---|---|---|---|
| Granum MN 2019(12) | To assess whether forced air warm-up in patients undergoing major spinal surgery prevents hypothermia compared to usual practice. | Quantitative: Pseudo-experimental, prospective, longitudinal, analytical. | 59 patients undergoing major spinal surgery. Age range 14 to 78 years. | The incidence of hypothermia at the start of surgery was significantly lower RR 0.28; 95% CI; 0.13-0.59. Comfort did not improve with the intervention. | 7/10 |
| Darvall J 2016(10) | To assess whether prewarming in patients undergoing neurosurgery decreased post-induction hypotension. | Quantitative, experimental, prospective, longitudinal, analytical. | 32 patients undergoing elective neurosurgery. | Prewarming did not decrease hypotension after induction, but it did increase the temperature significantly before induction. | 9/10 |
| KM Shin 2015(13) | Evaluate the effectiveness of prewarming the skin surface using a forced air heating blanket for 30 minutes prior to induction of anesthesia to prevent the decrease in core temperature that occurs during endovascular coiling of brain aneurysms and reduce the incidence of hypothermia. | Quantitative, experimental, prospective, longitudinal, analytical. | 72 patients undergoing endovascular management of cerebral aneurysm. | Intraoperative hypothermia decreased in patients undergoing a 30-minute warm-up.<br><br>Age range between 20 and 80 years. | 9/10 |

**Interpretation and application of evidence**

Warm-up for 30 minutes prevents redistribution hypothermia in patients undergoing elective neurosurgery (12). Different warming periods have been compared, concluding that periods between 10 to 20 minutes could prevent perioperative hypothermia (14). The presentation of perioperative hypothermia has been shown to increase mortality in patients undergoing elective surgery. The present study aimed to establish whether warming reduces mortality in patients undergoing elective neurosurgery.

Granum et al, carried out a pseudo-experimental study in 59 patients undergoing major spinal surgery, defined as spinal deformity surgery, the objective of which was to assess whether prewarming with hot air prevents hypothermia in patients undergoing spinal surgery. including non-obese patients from 14 years of age. Hypothermia at the start of surgery was lower in the intervention group (RR 0.28 CI 0.13-0.59; p <0.001), thus obtaining an NNT 190, which, although it might seem a useless measure, would have a adequate cost-benefit ratio, despite the fact that it did not reduce hypothermia at the end of surgery (RR 0.33; CI 0.04-3.03; P 0.61). The limitations of the study lie in the selection bias, given a non-probabilistic sampling, which makes it difficult to extrapolate its results. Furthermore, the follow-up of the patients was only carried out until the end of the surgery, so it does not respond to the clinical problem (12).

Darvall J et al, conducted a randomized clinical trial with 32 patients, who were assigned to warm air warm-up or standard care, in whom invasive hemodynamic monitoring was established. The intervention group had a higher temperature before induction 36.8°C (SD 0.4 C) vs 36.2 (0.2) °C p = 0.004, despite this there were no differences in the rate of hypotension or in the need for vasopressors during induction. The main limitation of this study is the change in the randomization protocol after the start of the study, constituting a selection bias. The induction protocol could have predisposed to a type 2 error, this due to the fact that the patients stopped being warmed up during induction, which exposed them to the environment of the operating rooms and this could have resulted in cooling and loss of heat. vasodilation gained during warm-up. This study did not have an intraoperative or postoperative follow-up, so it does not respond to the clinical problem raised (10).

KM Shin et al, carried out a randomized clinical trial with 72 patients, submitted to elective or emergent management, of cerebral aneurysms via endovascular route. The intervention was carried out with warm-up for 30 minutes with hot air. The temperature prior to induction did not have a significant difference, however, the temperature taken every 20 minutes for 120 minutes was higher in the intervention group in all periods of intraoperative time p <0.001. The absolute reduction in the risk of hypothermic episodes at the end of the surgery was 23.8%, which implies a number needed to treat (NNT) of 4 to avoid a case of hypothermia with the use of prewarming, being a measure that could be beneficial and with a good relation with its cost. This study has limitations such as the limited sample size, which makes it difficult to extrapolate its results. In addition, endovascular procedures are less painful, which causes the need for lower doses of analgesics in infusion such as remifentanil, and this affects the degree of vasodilation and sympatholysis generated by anesthetics, which ends up generating hypothermia. Finally, this study did not follow up the patients after the surgery was completed, so there are no data to answer the clinical problem posed (13).

**Clinical message**

There is evidence that warming up in patients undergoing elective neurosurgery reduces episodes of perioperative hypothermia, avoiding hypothermia during the intraoperative period decreases in-hospital mortality, and we wanted to know the evidence of whether warming decreased in-hospital mortality, however, there is limited evidence on this outcome. , mainly due to the fact that the existing studies have carried out their measurements in induction and during the intraoperative period, none have done so in the postoperative period, so more research is required to better address the clinical problem posed.

The patient in our clinical setting underwent warm-up, knowing that this has shown a decrease in hypothermia and improvement in comfort, who finally had surgery without complications and had a discharge 7 days after surgery, we do not know if the warm-up had an influence However, its use for at least 10 minutes is recommended in its clinical result, it has been shown to be useful for reducing episodes of hypothermia during induction and intraoperative, in addition to improving comfort, especially in patients undergoing major spinal surgery. and elective and urgent endovascular management of brain aneurysms.

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