

The Effects of Amino Acid Infusions on Core Body Temperature During the Perioperative Period: A Systematic Review

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The aim of this systematic review was to determine the effect of amino acid infusions on core body temperature and shivering. We searched the PubMed, EMBASE, CINAHL, and Cochrane Register of Controlled Trials databases to identify randomized controlled trials that met the inclusion criteria. A total of 11 eligible trials involving 506 participants were identified. Amino acid infusions were associated with shorter periods of mechanical ventilation and hospitalization and less perioperative shivering, mechanical intubation, and hospitalization in surgical patients without hepatic, renal, or severe metabolic disorders. It is recommended that infusions are warmed before administration to avoid further decrease in core body temperature.

Keywords: shivering, hypothermia, perioperative period, meta-analysis.

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HYPOTHERMIA OCCURS WHEN the body temperature drops to below 36°C (96.8°F).¹ Inadvertent hypothermia during the perioperative period, an important clinical problem, has been linked to adverse outcomes² such as coagulation disorders,³ surgical site infections,⁴ ischemic

myocardial events,⁵ postoperative shivering, and increased postoperative recovery and hospitalization.^{4,6}

Owing to the ambient temperature of the operating room, metabolism is decreased and the administration of anesthetics inhibits thermoregulation, which means that the core body temperature is reduced by about 0.5 ± 1.0°C immediately after the induction of anaesthesia.⁷ The prevalence of perioperative hypothermia is reportedly up to 70%,^{8,9} and the American Society of PeriAnesthesia Nurses has stated that all medical personnel are responsible for instituting preventive measures to minimize accidental hypothermia related to surgery.^{10,11}

Different approaches are used to treat patients who are hypothermic. Current nursing interventions for preventing hypothermia in the operating room include increasing the ambient room temperature, covering the patient's head and body, warming intravenous and irrigating solutions, and applying circulating set-temperature water devices and forced warm air devices. However, these techniques are seldom completely effective.^{11,12} Furthermore, a

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recent survey showed that intraoperative temperature monitoring was often overlooked, and only 39% of all patients were actively warmed.¹³ Therefore, evidence-based techniques for minimizing unplanned perioperative hypothermia in clinical practice should be actively sought.⁸

A systematic review recently reported that circulating water garments offered more effective temperature control than forced-air warming systems, and that both were better for temperature control than passive warming devices.¹⁴ Another systematic review reported that the use of room temperature irrigation fluid led to greater decreases in core body temperature and increased the risk of perioperative hypothermia and shivering compared with warmed irrigation fluid.¹⁵

An alternative technique is to promote the patients' own ability to generate heat by the infusion of amino acids, which are known to be effective at enhancing thermogenic effects and alleviating shivering during the perioperative period.¹⁶⁻²⁰ Studies have shown that amino acid infusions cause significantly greater increases in core body temperature than infusions of crystalloid solutions.^{21,22} In addition, a randomized controlled trial showed that preoperative infusion of amino acids was able to maintain normothermia, increase the speed of tracheal extubation, and reduce the amount of time spent in the intensive care unit (ICU) and in hospital. However, perioperative amino acid infusions have also been shown to have the inability to accelerate rewarming once intraoperative core hypothermia has developed.^{22,23} Moreover, Donmez et al²² reported that the incidence of shivering was similar among amino acid and saline recipients. Clearly, the ability of perioperative amino acid infusions to increase core body temperature and reduce the incidence of shivering remains controversial.

Nurses are often involved in selecting the most appropriate intraoperative warming method for preventing hypothermia. Therefore, the purpose of this systematic review was to investigate the effects of infusions of amino acids compared with crystalloid solutions on hypothermia and shivering.

Materials and Methods

Search Strategy

The following databases were searched from inception to June 2013, namely Medline, EMBASE, CINAHL, and the Cochrane Register of Controlled Trials. The search terms were as follows: "hypothermia," "hypothermic," "low temperature," "warming," "rewarming," "body temperature," and "amino acid." In addition, experts in the field were contacted and the reference lists of all selected studies were manually checked to ensure that all relevant studies were included. Searches were limited to studies in humans and were performed without language restriction.

Selection of Studies

The inclusion criteria were as follows: (1) randomized controlled trial; (2) participants aged 18 years or older and undergoing any type of elective surgery (there were no exclusions based on the type of anesthesia or disease); (3) interventions limited to infusions of amino acids or crystalloid solutions; and (4) studies had to evaluate at least one of the following outcome variables, namely reductions in body temperature, the incidence of shivering, the average increase in oxygen uptake, intraoperative blood loss, the duration of postoperative intubation, and hospital stay.

Quality Assessment

The methodological validity of the randomized controlled trials selected for inclusion was assessed independently and strictly by two authors according to the criteria recommended in Cochrane Handbook 5.0.1 for Systematic Reviews of Interventions.²⁴ Assessments were based on the method of random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, reporting of dropout rates and missing data, the use of intention-to-treat (ITT) analyses, and baseline comparability. Articles meeting the above-mentioned criteria were rated A if only a small degree of bias was present; B, if a moderate degree of bias was present; and C, if a high degree of bias was present. After the independent quality assessment, the two authors independently assessed every article and discussed the assessments for each

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