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The Effects of Perioperative Infusions of Amino Acid on Core Body Temperature

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Introduction of Perioperative Hypothermia

Hypothermia occurs relatively when the core body temperature drops to below 36°C (96.8°F). Factors resulting in perioperative hypothermia include operating room temperature, type of surgical procedure and length of anaesthesia. Inadvertent hypothermia during the perioperative period has been linked to adverse outcomes such as surgical site infections, coagulation disorders, postoperative shivering, ischemic myocardial events, and increased postoperative hospitalization [1,2]. The prevalence of perioperative hypothermia is up to 70%, and the American Society of Perianesthesia Nurses has stated that all medical personnel should institute preventive measures to minimize perioperative hypothermia [3]. Different interventions are used to treat patients who are hypothermic. Current nursing approaches for preventing perioperative hypothermia include increasing the operation room temperature, warming intravenous and irrigating solutions, covering the patient's head and body, and applying circulating set-temperature water devices. However, these techniques are seldom completely effective. Furthermore, a recent survey showed that intraoperative temperature monitoring was often neglected, and only 39% of all patients were actively warmed [4]. Therefore, evidence-based techniques for minimizing perioperative hypothermia should be actively explored. 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 [5]. 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 [6].

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 [7]. Studies have shown that amino acid infusions cause significantly greater increases in core body temperature than infusions of crystalloid solutions. 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 ICU and in hospital. Clearly, the ability of perioperative amino acid infusions to increase core body temperature and reduce the incidence of shivering remains controversial.

Effects of Amino Acid Infusions

According to Moriyama et al. [7], esophageal core temperatures became significantly higher in the amino acid infusion group than in the saline infusion group from 150 min after induction of anesthesia until the end of surgery (P0.005). At the end of surgery, temperatures in the two groups were 35.6°C (35.3–35.8)°C in the control group vs. 36.1°C (35.9–36.3)°C in the amino acid group (P0.01). Zhou et al. [8] searched PubMed, EMBASE, CINAHL, and the Cochrane Register of Controlled Trials for controlled trials that meet the inclusion criteria. Eleven eligible randomised controlled trials enrolling 506 participants were identified with meta-analysis. Ten of the studies were in English, and 1 study was in Japanese. The results showed that crystalloid solution infusions caused a greater drop of core body temperature in patients, compared to amino acid infusions (SMD: 1.57; 95% CI: 0.79 to 2.35, I2=91%; p<0.00001). The occurrence of shivering (RR=2.96; 95% CI: 1.71 to 5.15, I2=14%; p=0.0001) in the groups having amino acid infusions were lower than the group of studies having crystalloid solution infusions. Additionally, compared with crystalloid solution infusions, amino acid infusions shorten duration of postoperative mechanical intubation (WMD: 119.72; 95% CI: 60.15 to 179.29, I2=48; p<0.0001) and duration of hospitalization (WMD: 1.80; 95% CI: 1.54 to 2.06, I2=0; p<0.00001).

Relative Contraindications of Amino Acid Infusions

Adverse effects accompanying the clinical use of amino acids were not reported in any of the included studies, but the risk of harmful complications should be considered. Amino acid infusions may be harmful for patients with insufficient cardiopulmonary, hepatic, or renal function and those with severe metabolic disorders. Nurses involved in decision making about the use of amino acid infusions should be aware that amino acids might be contraindicated or only suitable for use in low doses in such patients [9].

Mechanisms of beneficial outcomes of amino acid

Thus, infusions of amino acids may be superior to external heating with regard to other postoperative complications, such as disturbances of the coagulation system and surgical site infections. The beneficial effects of amino acid infusions challenge the speculation that it is "internal heating" from amino acids that increases body heat during surgery. The mechanisms responsible for thermoregulatory effects are not completely understood, but the central thermoregulatory system may be involved by stimulating resting energy expenditure, and hence heat production. Various other mechanisms may also explain these beneficial outcomes [10]. One potential mechanism may be the better maintenance of core body temperature by patients who receive amino

acid rather than crystalloid solution infusions. Furthermore, amino acid infusions during surgery reduce nitrogen excretion, which leads to better patient outcomes after surgery. A third possibility is a decrease in bacterial translocation. Numerous reports have shown that amino acids administered via a gastric tube reduce translocation of intestinal bacteria.

Implications for nursing

Nurses are often involved in selecting the most appropriate intraoperative warming method for preventing hypothermia. Maintaining normothermia in the operating room is important for nurses, and currently available systems for preventing intraoperative heat loss (forced air warming, warmed blankets, electric heating pads, devices for warming infusion fluids, and circulating set-temperature water devices) provide hope that patients will leave the surgical suite without shivering. Because effective methods of reducing heat loss have been available for a number of years, maintenance of intraoperative normothermia to minimize procedure-related risk and improve patient comfort is indicated [10]. However, heating strategies is not standard. Nurses still face the challenge of keeping patients warm before, during, and after the surgery. The current literature attaches more importance to combining several techniques for minimizing heat loss of surgical patients rather than focusing on a single preventive strategy. Further research is essential to expand and support research findings regarding the most effective nursing interventions for minimizing the incidence of hypothermia and shivering throughout the perioperative period. This suggests that efforts would be best focused on further optimizing the effectiveness of amino acid infusions rather than those of currently available systems. The favourable effects of reducing the incidence of postoperative shivering cannot be questioned. Notably, the benefits of all systems of amino acid infusions need to be considered in the light of initial and on-going maintenance costs, which may preclude advocacy of widespread use of the technique. Studies of costs remain scant and further research is required to determine the cost-benefit ratio of the various infusions.

Conclusions and Relevance to Clinical Practice

Amino acid infusions which is associated with a shorter period of mechanical ventilation and hospitalization is recommended to be warmed to decrease the drop of core body temperature, the occurrence of perioperative shivering, duration of postoperative mechanical intubation and hospitalization in surgical patients without hepatic, renal, or severe metabolic disorders. This suggests that nurses should actively use amino acid infusions during surgery. However, in most countries, this decision is made by surgeons or the anesthesia provider but not nurses. It is therefore crucial to raise awareness of the importance of amino acid infusions among these disciplines. It is important that all disciplines involved in the care of the perioperative patient unite regarding the implementation of amino acid infusions and other effective thermal strategies for maintaining normothermia throughout surgery.

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