ORIGINAL ARTICLE

A Clinical Trial of the Effect of Warm Intravenous Fluids on Core Temperature and Shivering in Patients Undergoing Abdominal Surgery

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Purpose: *This study was conducted to investigate the effect of warm intravenous fluids on shivering and core temperature of patients undergoing abdominal surgery.*
Design: *This study was a two-group clinical-control trial.*
Methods: *Ringer's solution at normal room temperature and serum at 38°C were infused in the control and intervention groups, respectively. Shivering, core temperature, SpO_2, and vital signs were measured at admission to the operating room and postanesthesia care unit (PACU) and 30 minutes after the admission to the PACU.*
Findings: *There was a significant difference between the two groups in terms of shivering, core temperature, and pulse rate at the time of admission to the PACU and 30 minutes after.*
Conclusions: *Ringer's solution at 38°C instead of room temperature can be used to reduce the incidence of postanesthetic hypothermia and shivering in patients undergoing abdominal surgery. Using this method in addition to other nursing care is recommended preoperatively.*

Keywords: *core temperature, postoperative shivering, intravenous fluid, abdominal surgery, postoperative hypothermia.*

SHIVERING IS A COMMON COMPLICATION in the postoperative period, and has a direct relationship with core body temperature.[1] Shivering occurs in about 50% of patients with a core temperature of 35.5°C and in 90% of patients with a core temperature of 34.5°C.[2] On the basis of the general theory, the cause of shivering is thermoregulatory due to core or skin hypothermia triggered by preoperative heat loss.[3] When the signals from cold receptors increase, the motor center of shivering in the posterior hypothalamus is activated and sends signals to anterior motor neurons of the spinal cords. Initially this increases the tone of skeletal muscles in the whole body, and when the signals from the cold receptors and the posterior hypothalamus rise higher than a certain level shivering is observed.[4]

Postanesthetic shivering is spontaneous, rhythmic, oscillating, and tremorlike.[5] Postoperative shivering not only leads to adverse feelings for the

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Conflict of interest: None to report.

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patients, but it also increases the body's metabolism and as a result increases the heart rate, cardiac output, and ventilation volume.[1,6] In addition, the tension on the incision site increases, and postoperative shivering may cause vasoconstriction, hypoperfusion, and metabolic acidosis. Shivering may also affect the function of platelets, disturb the repolarization of heart, and delay most of drug metabolism.[6]

In fact, shivering is part of the body's defense mechanism response by setting the central heating of body, which can create considerable harmful effects on the systemic oxygen consumption, oxygen of brain tissue, and intracranial pressure.[7] Reducing core body temperature is associated with the incidence of postoperative shivering and results in physiological adverse effects such as changes in protein metabolism, inhibiting the enzymatic reactions and coagulation disorders.[1,8] General and spinal anesthesia can lead to the shivering phenomenon.[9] In general anesthesia, there is a rapid decrease in core temperature because of shifting of body heat from the core to the perimeter, which leads to vasodilation. After that there is a slower reduction in core temperature that results from heat loss exceeding heat production. Regional anesthesia produces a similar pattern of general anesthesia. Moreover, regional anesthesia through its peripheral blocking effects also prevents shivering and vasoconstriction because of the decreasing sensation of cold from the peripheral nerves. This combination of vasodilation and blocked cold sensory input leads to a paradoxical experience of the patient's having sustained a significant heat loss with shivering. In addition, receiving supplemental sedatives and opioids most likely increases their hypothermia.[4,10,11] Altogether, anesthesia also increases the threshold response to heat and will also reduce the threshold response to cold.[12]

Central hypothermia induced processes are similar in general and regional anesthesia.[13] As in general anesthesia, initial hypothermia in the anesthesia site is caused by the redistribution of body heat from the center to the environment. Patients who have had spinal or epidural anesthesia cannot produce balanced core temperatures again, because the remaining peripheral vasoconstriction disrupts it.[13] In addition, reduction in core body temperature can result in the loss of body heat due to exposure to cold temperature in the operating room (OR), disruption in the normal mechanisms of temperature adjustment due to vasodilation, and receiving cold fluids.[14] The greatest reduction of SpO_2 and the increase in heart rate is related to the first few minutes after fasciculation and shivering.[15] These aforementioned factors can make patients susceptible to risks of angina, arrhythmias, heart attacks, and even death.[16]

Shivering time can last from 5 to 35 minutes after discontinuation of anesthesia.[17] Although the exact incidence is unknown, about 5% to 66% of patients in the recovery period experience shivering postanesthetically.[17] To cope with shivering, different pharmacologic and nonpharmacologic methods are used. Given that pharmaceutical approaches have some complications such as nausea and vomiting, dizziness, drowsiness, hypotension, constipation, and respiratory depression, nonpharmaceutical approaches to treatment are needed.[18] In choosing nonpharmaceutical approaches, it should be considered that maintaining postanesthetic normothermia is very difficult and that postanesthetic shivering may occur unrelated to hypothermia.[16] If we limit ourselves by using medicine to prevent shivering, heat recovery would be slow and the patient would be deprived of an important defense mechanism against decreasing core temperature. Therefore, to prevent shivering, preventive measures for hypothermia must be taken first in the intraoperative phase before the arrival of patient in the postanesthesia care unit (PACU).[13]

Some of the prevention and management methods used in other studies include warming and humidifying the airway, warming the skin with warm coatings, heating the air, and infusion of intravenous fluids.[13,14,19] In addition, use of this type of complementary therapy is one of the professional goals of nursing in improving patient comfort.[20] Heating the skin during surgery or heating the OR environment is difficult. Use of methods such as giving hot liquids to patients to maintain the core temperature greater than 36°C can reduce the adverse effects of hypothermia.[13] Intravenous warm fluids can help to minimize heat loss and as an advantage are often administered for fluid replacement.[11] Moreover, fluid therapy can also reduce postoperative hemodynamic complications.[21] Ringer's solution, a crystalloid fluid