

# Perioperative normothermia to reduce the incidence of surgical wound infection and shorten hospitalisation

Ref: Andrea Kurz et al. N Engl J Med 1996;334:1209-15.

This study tested the hypothesis that mild core hypothermia increases both the incidence of surgical wound infection and the length of hospitalisation in patients undergoing colorectal surgery.

Forced-air warming combined with fluid warming was used to maintain normothermia in the treated patients, whereas the unwarmed patients had core temperatures approximately 2°C below normal.

Wound infections are common and serious complications of anaesthesia and surgery. A wound infection can prolong hospitalisation by up to 20 days and substantially increase medical costs.

Although safe and inexpensive methods of warming are available, perioperative hypothermia remains common. Mild perioperative hypothermia during major surgery, may promote surgical-wound infection by triggering thermoregulatory vasoconstriction, which decreases subcutaneous oxygenation. Reduced levels of oxygen in tissue impair oxidative killing by neutrophils and decrease the strength of the healing wound by reducing the deposition of collagen. Hypothermia also directly impairs immune function.

Hypothermia itself may delay healing and predispose patients to wound infections. Maintaining normothermia intraoperatively is likely to decrease the incidence of infectious complications in patients undergoing colorectal resection.

## Thermal care

In this study 200 patients undergoing colorectal surgery were randomly assigned to routine intraoperative thermal care (the hypothermia group) or additional warming (the normothermia group). The surgeons remained unaware of the group assignments. The patients' anaesthetic care was standardised, they were all given cefamandole and metronidazole and their wounds were evaluated daily.

Wounds containing culture-positive pus were considered infected.

The patients were 18 to 80 years of age and underwent elective colorectal resection for cancer or inflammatory bowel disease. Patients scheduled for abdominal-peritoneal pull-through procedures were included, but not those scheduled for minor colon surgery (e.g. polypectomy or colostomy performed as the only procedure).

## Wound infections

The number of wound infections (as defined by the presence of pus and a positive culture) was evaluated by an observer unaware of the patients' temperatures and group assignments.

Nine infections occurred in the 38 patients assigned to hypothermia, but there were only four in the 42 patients assigned to normothermia.

At the induction of anaesthesia, each patient was randomly assigned to either the normothermia group, in which the patients' core temperatures were maintained near 36.5°C, and the hypothermia group, in which core temperature was allowed to decrease to approximately 34.5°C.

In both groups, intravenous fluids were administered through a fluid warmer, but the warmer was activated only in the patients assigned to extra warming. Similarly, a forced-air cover was positioned over the upper body of every patient, but it was set to deliver air at the ambient temperature in the hypothermia group and at 40°C in the normothermia group.

Shields and drapes were positioned so that the surgeons could not see the temperature of the fluid heater and the forced-air warmer. The surgeons, still unaware of the patients' group assignments and core temperatures, determined when to begin feeding them after surgery, remove their sutures, and discharge them. The timing of discharge was based on routine surgical considerations, including the return of bowel function, the control of any infections, and adequate healing.

The patients' surgical wounds were evaluated daily during hospitalisation and again two weeks after surgery. Wounds were suspected of being infected when pus could be expressed from the surgical incision or aspirated from a loculated mass inside the wound. Samples were cultured for aerobic and anaerobic bacteria, and wounds were considered infected when the culture was positive for pathogenic bacteria. All the wound infections diagnosed within 15 days of surgery were included in the data analysis.

Maintaining intraoperative normothermia is likely to decrease infectious complications and shorten hospital stays in patients undergoing colorectal surgery.

## Key findings:

- Intraoperative vasoconstriction was seen in 74% of the patients assigned to hypothermia but in only 6% of those assigned to normothermia.
- Core temperatures at the end of surgery were significantly lower in the hypothermia group and remained significantly different for more than five hours postoperatively.
- Postoperative vasoconstriction was observed in 78% of the patients in the hypothermia group; in contrast, vasoconstriction, usually short-lived, was observed in only 22% of the patients in the normothermia group.
- Shivering was observed in 59% of the hypothermia group, but in only a few patients in the normothermia group.
- Thermal comfort was significantly greater in the normothermia group.
- The overall incidence of surgical wound infection was 12%. Although the scores for the risk of infection were similar in the two groups, there were only 6 surgical-wound infections in the normothermia group, compared with 18 in the hypothermia group.
- Four patients in the normothermia group and seven in the hypothermia group required admission to the intensive care unit. Two patients in each group died during the month after surgery.
- Significantly more collagen was deposited near the wound in the patients in the normothermia group than in the patients in the hypothermia group.
- Patients assigned to hypothermia were first able to tolerate solid food one day later than those assigned to normothermia.
- Sutures were removed one day later in the patients assigned to hypothermia.
- The duration of hospitalisation was shorter in the normothermia group.

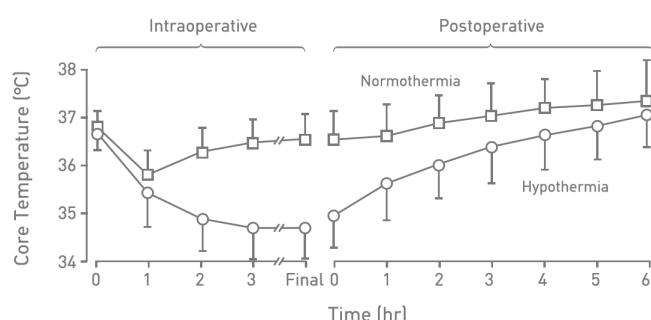
The cost of a prolonged hospitalisation must exceed the cost of fluid and forced-air warming (approximately US\$30 in the US).

## Resistance to infection

The initial hours after bacterial contamination are a decisive period for the establishment of infection.

In surgical patients, perioperative factors can contribute to surgical wound infections, but the infection itself is usually not manifest until days later.

The patients with mild perioperative hypothermia had three times as many culture-positive surgical wound infections as the normothermic patients. In the patients assigned to hypothermia the reduction in resistance to infection was twice that in the normothermia group.



Core temperatures during and after Colorectal Surgery in the study patients.

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