

# The effects of mild perioperative hypothermia on blood loss and transfusion requirement

Suman Rajagopalan, MD. et al  
Anesthesiology 2008; 108:71–7

Anaesthetic-induced hypothermia is known to reduce platelet function and impair enzymes of the coagulation cascade. The objective of this systematic review was to evaluate the hypothesis that mild perioperative hypothermia increases surgical blood loss and transfusion requirement. A search of published randomised trials compared blood loss and/or transfusion requirements in normothermic and mildly hypothermic (34–36°C) surgical patients.

Fourteen studies were included in analysis of blood loss, and 10 in the transfusion analysis. The median temperature difference between the normothermic and hypothermic patients among studies was 0.85°C. The ratio of total blood loss in the normothermic and hypothermic patients was 0.84. Normothermia also reduced transfusion requirement.

The conclusion was that even mild hypothermia (<1°C) increases blood loss by approximately 16% and increases the relative risk for transfusion by approximately 22%. Maintaining perioperative normothermia reduces blood loss and transfusion requirement by clinically important amounts..

## Heat loss

Anaesthetic-induced thermoregulatory impairment produces hypothermia in unwarmed surgical patients. It results initially from an internal core-to peripheral redistribution of body heat and subsequently from heat loss exceeding metabolic heat production.

Randomised trials indicate that even mild hypothermia (approximately 2°C) causes complications including morbid myocardial outcomes, surgical wound infection, prolonged recovery and hospitalisation, negative nitrogen balance, shivering and thermal discomfort.

Hypothermia also impairs platelet function, primarily by impairing release of thromboxane A<sub>2</sub>, which is necessary for formation of an initial platelet plug. It also impairs the function of enzymes in coagulation. This effect is often unrecognised clinically because coagulation tests are normally performed at 37°C, irrespective of the patient's actual core temperature. When various in vitro tests are performed at various temperatures, however, impairment is obvious.

But whether mild perioperative hypothermia causes a clinically important coagulopathy remains controversial. An initial study that specifically evaluated this question found that hypothermia increases both blood loss and transfusion requirement. However, a subsequent similar study reported that hypothermia increased neither. Other studies have reported that mild hypothermia increases blood loss and/or transfusion requirement, does neither, or even reduces blood loss.

**The authors present a systematic review and analysis evaluating the hypothesis that mild perioperative hypothermia increases surgical blood loss and transfusion requirement**

They completed a systematic search for published, randomised, controlled trials that compared normothermic patients with those who had mild intraoperative hypothermia (34–36°C). Among these studies, only trials that reported blood loss, transfusion requirement, or both as an outcome were included in the analysis.

Two authors independently scrutinised each published report and selected those to be included in the analysis. The medical literature published since 1966 was searched in all languages using electronic databases and the last electronic search was in October 2006.

A search using key words retrieved approximately 1,800 articles, but the authors excluded retrospective studies or those in which the core temperature reduced to less than 34°C, local cooling methods had been used, or the sample size was smaller than 15.

The information obtained included:

- the number of patients
- type of surgery and anaesthetic used
- operating room temperature
- patient's core body temperature at the end of surgery
- amount of blood loss
- number of patients receiving transfusion, and the transfusion requirements.

Meta-analysis methods were used to assess the comparative effect of normothermia versus hypothermia on both total blood loss and whether a patient received any transfusion.

The effect of normothermic versus hypothermic temperature was then summarised as the ratio of normothermic to hypothermic mean blood loss for each study, allowing comparison of studies with quite differing volumes of blood loss.

## Results

Of the 18 studies that met the criteria, 15 trials reported blood loss, of which seven reported only intraoperative loss, two reported only postoperative loss, and five reported both intraoperative and total loss.

Thirteen studies compared transfusion requirements in normothermic versus hypothermic patients. Three trials were excluded because there was no mention of the number of patients requiring transfusion. Hence, 14 studies were included in analysis of blood loss whereas 10 studies were included in the transfusion analysis.

The respective blood loss and transfusion studies evaluated a total of 1,219 and 985 patients. The median of the mean temperatures reported for patients in the normothermic groups among the 14 blood loss studies was approximately 36.6°C, whereas it was 35.6°C in patients assigned to hypothermia.

**Results indicate that normothermia is associated with significantly lower blood loss than hypothermia, at least for the aggregate types of surgeries considered and for normothermia and hypothermia as defined in these studies. Normothermia as defined in these studies is also associated with a reduced need for transfusion compared with hypothermia.**

## Increased blood loss

Analysis indicates that even mild hypothermia increases blood loss by an estimated 16%. Although not an enormous treatment effect, these data add to other studies that demonstrate that preventing hypothermia decreases the risk of many other complications and is thus indicated for reasons other than reducing blood loss.

There is not a simple relationship between blood loss and transfusion requirement but averaged across a sufficient number of patients and a variety of operations, increased blood loss presumably increases transfusion requirement.

The results are consistent with this theory: mild hypothermia significantly increased the relative risk for transfusion by approximately 22%.

**Reducing transfusion seems especially important now that increasing evidence suggests that transfusions are far more harmful than previously believed.**

This analysis was restricted to mild hypothermia, but in fact, the median of the mean temperatures among studies for the patients assigned to hypothermia was approximately 35.6°C, which was only about a degree less than the median for the normothermic patients. Hypothermia in the studies evaluated was of a magnitude that is typical for unwarmed surgical patients. Therapeutic hypothermia purposely induced to lower temperature will, presumably, produce yet greater impairment of coagulation.

Unwarmed patients undergoing larger and longer operations are more likely to become hypothermic than those having shorter and smaller procedures. They are also likely to lose more blood.

**Note:** Blood loss and transfusion requirement were the primary outcomes for some of the articles included in the analysis but coagulopathy was a secondary or even incidental finding in others. This is an important distinction because potential confounding factors are usually only well controlled for the primary outcome. Secondary or incidental findings are often only reported when statistically significant; reported outcomes may thus overestimate the actual effect. Nonetheless, the effects of hypothermia were generally similar in studies in which blood loss and transfusion requirement were primary or secondary outcomes.

Find out more at [www.molnlycke.com](http://www.molnlycke.com)