Interventions to Assist Perioperative Temperature Management for Women Undergoing Cesarean Section

Recommendations*
- Preoperative warming strategies should be utilized where possible for women undergoing cesarean section (Grade B)
- Administration of warmed IV fluids should be standard practice for preoperative and/or perioperative cesarean section (Grade A)
- Under-body warming mattresses should be used pre and perioperatively for cesarean section surgery (Grade A)
- Upper-body forced air warming should be utilized preoperatively (Grade B)
- Strategies such as ambient temperature maintenance should be used to maintain thermal comfort for the patient (Grade B)
- It is important to consider that warming strategies are less effective when intrathecal opioids are administered (Grade B)

*For a definition of JBI's ‘Grades of Recommendation’ please see the last page of this sheet

Information Source
This Best Practice Information Sheet has been derived from a systematic review published in 2013 in the JBI Database of Systematic Reviews and Implementation Reports. The systematic review report is available from the Joanna Briggs Institute (www.joannabriggs.org).

Background
Women undergoing cesarean section (CS) are vulnerable to the adverse effects associated with a drop in core temperature during surgery, known as inadvertent perioperative hypothermia (IPH). This is partly because this surgery is often performed under neuraxial anesthesia (NA); as well as from higher rates of blood and fluid loss. Increased blood loss and transfusion requirements stem from impaired platelet function in hypothermic patients. The prevention of hypothermia is especially beneficial for CS patients as perioperative bleeding can pose significant problems. Inadvertent perioperative hypothermia has also been associated with delayed wound healing, decreased immune response leading to increased wound infection rates, prolonged stay in the Post Anesthetic Care Unit (PACU), prolonged hospital stay and increased costs, altered drug metabolism and increased likelihood of cardiac arrhythmia.

Vasodilation occurs in all pregnant patients and predisposes those who undergo CS to IPH. This vasodilation is further exacerbated by NA, thus increasing heat loss. Oxytocics, the drugs given to promote delivery of the placenta and reduce the risk of hemorrhage, also produce vasodilation thus increasing heat loss. CS patients may also be particularly vulnerable to hypothermia due to the amount of exposure required during surgery, as well as the large amount of fluid loss experienced, particularly during emergency CS. Hypothermia can be initially undetected during NA, especially when temperature is not monitored by the anesthetist. Behavioral thermoregulation can also be impaired; CS patients may not perceive or report that they are cold. It has been suggested that all CS patients should receive intraoperative warming, as lack of perioperative temperature management means that the rate of hypothermia in CS patients with NA could be as high as 80%.
Management for Women Undergoing Cesarean Section

Objectives

The purpose of this Best Practice Information Sheet is to present the best available evidence in relation to the effectiveness of interventions to prevent hypothermia in mothers after CS surgery.

Types of Intervention

The review considered studies that evaluated the effectiveness of active or passive warming methods, versus usual care or placebo, that aimed to limit or manage core heat loss as applied to women undergoing CS.

Quality of the research

The studies were appraised using the standardized critical appraisal instruments for randomized controlled trials from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instruments (JBI-MAStARI). Data was extracted using a customized data extraction tool, based on the JBI data extraction tool for quantitative studies. Two reviewers appraised the studies independently. Twenty-six studies were critically appraised and 12 studies, with 719 participants, met the inclusion criteria. All 12 included studies were randomized controlled trials; however, based on the randomization method used, blinding of participants and researchers to treatment allocation, and inclusion in the analysis of participants who withdrew from the study, one study was rated as being of high quality, five moderate quality and six low quality. The six low quality studies were considered to have unclear or less than rigorous randomization methods.

Findings

Intravenous Fluid Warming

A study investigating warmed intravenous (IV) fluids and reflective blanket versus unwarmed IV fluids and reflective blanket found that tympanic temperature at the time of delivery was higher in patients with warmed IV fluids compared to those with unwarmed IV fluids, and remained so at 15, 30 and 45 minutes after delivery. Another study found that the average core temperature at the end of anesthesia was also higher in patients administered pre-surgery warmed IV fluids versus room temperature fluids.

A similar study also found a significantly greater number of hypothermic patients after surgery for the group administered room temperature IV fluids compared to the warmed IV fluids group. A study of warmed IV fluids plus warmed skin preparation fluids and extra clothing versus room temperature fluids found a statistically and clinically significant lower drop in the mean aural temperature and the mean bladder temperature from baseline to arrival in the recovery room. Three studies found that administration of warmed fluid preload versus room temperature fluids (administered in the operating theatre prior to anesthesia) appears to result in higher temperatures when measured 60 minutes after induction of anesthesia or in the recovery phase. Two studies comparing warmed and unwarmed IV fluids, combined in meta-analysis, found that administration of warmed IV fluids compared to room temperature fluids resulted in a significantly higher mean temperature on arrival to PACU.

Warmed IV fluids administered both before and during surgery appeared to have benefits for increasing maternal temperature, as measured in the latter intraoperative phase and into the recovery phase, until discharge.

A single study that compared an intervention of warmed fluids, warmed skin preparation and additional clothing with another intervention of room temperature fluids, room temperature skin preparation and single hospital gown did not find a significant difference in the incidence of shivering between groups. Five studies comparing IV fluid warming with room temperature fluids were combined in a meta-analysis, with the result significantly favoring IV fluid warming for reducing shivering in this population.

Warmed IV fluids are effective for raising the temperature of CS patients whether administered pre or intraoperatively, and are also effective at reducing shivering.

Warming Devices: Covers and Mattresses

Five studies compared warming devices with other interventions. One study used a three group design with upper-body forced air pre-warming plus unwarmed IV fluid preload versus warmed IV fluid preload with no forced air warming versus unwarmed fluid preload with no forced air warming. The remaining four studies used a two group design; with two comparing upper-body forced air warming and warmed IV fluids with a cotton blanket and warmed IV fluids. One compared an under-body carbon polymer warming blanket switched on and warmed IV fluids with a carbon polymer warming blanket switched off and warmed IV fluids. The last study compared under-body forced air warming and warmed IV fluids with warmed cotton blankets and warmed IV fluids.

A study of a carbon polymer mattress turned on versus carbon polymer warming mattress turned off presented useful data relating to the incidence of IPH in both groups. The authors found a significantly lower incidence of IPH in the intervention group versus the control group. Another study comparing use of a forced air warming mattress and warmed IV fluids versus warmed cotton blankets and warmed IV fluids also found a significant difference between groups in relation to mean maternal temperature on entering PACU.

The summary estimate of these two studies, when combined using meta-analysis, favor under-body warming in comparison to warmed cotton blankets or warmed IV fluids alone, for increasing temperature on admission to PACU. Similarly, another study reported statistically significant core temperature decreases at 45 minutes, finding that there was less temperature decrease in the warmed IV fluid and forced air warming groups than the control group. Another study of pre-warming found that patients in the forced air warming group had statistically significantly higher final core temperatures in the operating theatre. Alternatively, a study of intraoperative upper-body forced air warming found that mean temperature decrease between the measured time periods was not statistically or clinically significant between the groups. Similarly, difference in the mean final temperature on exit from the operating theatre was not significant between the groups.

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These results suggest that preoperative forced air warming plus intraoperative warming is more effective than intraoperative forced air warming alone in relation to maintaining maternal intraoperative temperature. In terms of the utility of forced air warming in reducing shivering, results are mixed. One study found that there was no statistically significant difference between the forced air warming and control groups; while another found that there was a significantly lower level of shivering in the preoperative forced air warming group. Additionally, results from another study also support the effectiveness of preoperative forced air warming in reducing shivering, but not to the extent of warmed IV fluids. Results from these studies suggest that forced air warming applied in the preoperative phase of care reduced shivering, but forced air warming applied intraoperatively may have less effect on reducing shivering.

Forced air warming, or the use of blankets or garments that blow warm air on to the surface of the body, is effective for raising the temperature of CS patients, particularly if applied preoperatively. Under-body warming, involving the use of heated mattresses, also appears to be useful in maintaining maternal core body temperature during CS. Preoperative forced air warming was also found to reduce shivering.

Leg Wrapping

Only one study investigated the use of leg wrapping in maintaining maternal temperature during CS, and compared leg wrapping with tight elastic bandages with leg wrapping with loose elastic bandages in women undergoing elective CS surgery under epidural anesthesia. This found no significant difference between the two groups in maternal temperature or shivering. Therefore, leg wrapping was not effective at improving maternal temperature or shivering; however, these observations are derived from a single study and should therefore be considered with caution.

Conclusions

Preoperative warming interventions tend to lead to improved maternal thermoregulatory outcomes in CS surgery. The warming of IV fluids increases perioperative and postoperative temperatures, whether given pre or intraoperatively. Upper-body forced air warming applied in the preoperative phase achieves better maintenance of temperature than if applied only during the intraoperative phase. There is also evidence to suggest that under-body warming mattresses are effective at maintaining normothermia; having been shown to be effective at increasing postoperative temperatures on arrival to PACU.

Whether interventions to maintain core body temperature in women undergoing CS also improve thermal comfort is less clear, and may depend on a number of factors, including ambient temperature and the setting of the warming device in question. Both warmed IV fluids and forced air warming interventions (applied preoperatively) have a positive effect on reducing shivering. Recommendations made for general adult groups may be applied to the population of women undergoing CS surgery under neuraxial anesthesia.

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Participants
A participant/actor e.g. specific health care professional, a patient group or carer. May include presentation
Condition/Diagnosis or Presentation
A condition or diagnosis e.g. ‘acute wound’ or specific condition that has arisen e.g. ‘infection’
Action
A suggested action that can be taken as well as a grade of recommendation
Context
A specific context or situation e.g. ‘emergency ward’ or ‘remote health clinic’
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References

JBI Grades of Recommendation*

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This Best Practice Information Sheet presents the best available evidence on this topic. Implications for practice are made with an expectation that health professionals will utilize this evidence with consideration of their context, their client’s preference and their clinical judgement.†

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