A systematic review of the effectiveness of cutaneous warming systems to prevent hypothermia

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CRD summary
This review concluded that carbon-fibre blankets and forced-air warming systems were equally effective in preventing hypothermia during surgery in elective patients, while circulating-water garments were the most effective in maintaining normothermia. This was a generally well-conducted review and the authors' conclusions appear to reflect the evidence, but limitations with the included trials should be taken into consideration.

Authors' objectives
To assess the effectiveness of cutaneous warming systems in the prevention of hypothermia in elective patients during surgery.

Searching
CINAHL, MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials (CENTRAL) were searched between January 2000 and April 2007 for publications in English, Spanish or Portuguese. Search terms were reported. In addition, references were manually searched to identify additional relevant papers.

Study selection
Randomised control trials (RCTs) comparing cutaneous warming systems with usual care or an active cutaneous warming system without pre-warming, during the intraoperative period, in non-emergency surgical patients aged 18 years or more, were eligible for inclusion. Trials were excluded if they deliberately induced hypothermia for the protection of vital organs. The primary outcome was central body temperature (tympanic, oral, distal oesophageal, or rectal).

Included trials compared forced-air warming systems with: other types of forced-air warming systems; passive systems (cotton blankets or reflective blankets); active cutaneous warming systems (circulating-water mattress, radiant warming systems; circulating-water garment and carbon-fibre resistive heating). Types of surgical procedure varied, but the majority of patients received general anaesthesia. Some trials included only men, while others included only women.

Two reviewers selected studies for inclusion.

Assessment of study quality
Two reviewers assessed the quality of the included trials using the Jadad scale, including criteria on randomisation, blinding and attrition, and then cross-checked for accuracy. The maximum score was 5 points. Trials were also assessed for adequate allocation concealment. Discrepancies were resolved by consensus.

Data extraction
Two reviewers independently extracted data using a previously validated instrument and then cross-checked for accuracy.

Methods of synthesis
Due to clinical and methodological heterogeneity, data were presented as a narrative synthesis and in tables, grouped by the type of comparison warming intervention.

Results of the review
Fourteen RCTs (n=1,191 patients) were included in the review. Sample sizes ranged from 20 to 324 patients. Thirteen trials scored 3 points on the Jadad scale (moderate quality).

Forced-air warming systems significantly improved temperatures during the intraoperative period compared with
passive insulation warming systems (three of four trials) and radiant warming systems (two of three trials).

Circulating-water garment systems were significantly more effective than forced-air warming systems (three trials) and carbon-fibre blanket warming systems (one trial).

There were no significant differences between different types of forced-air warming systems (two trials). Forced-air warming systems significantly improved temperatures compared with circulating-water mattress, but no significant differences were seen with carbon-fibre resistive heating blankets (two trials).

Cost information
One trial reported a cost of $1,470 per forced-air warming system unit compared with $5 for cotton blankets and £22 for reflective blankets. Five years use of the forced-air warming system for one to two patients per day would translate into a cost of less than $1 per patient.

By comparison, one trial reported a cost of $14.16 per patient using a disposable forced-air warming blanket, compared with the $2 washing cost for cotton blankets.

Authors' conclusions
Carbon-fibre blankets and forced-air warming systems were equally effective in preventing hypothermia, while circulating-water garments were the most effective to maintain normothermia.

CRD commentary
The review question was clear and was supported by appropriate inclusion criteria for participants, interventions, controls, and study design. Specific outcomes of interest were not pre-specified. The literature search included a number of databases and other appropriate sources, but as searches were restricted by language, language bias could not be ruled completely out. As the authors acknowledged, because unpublished data were not sought, potentially relevant data may have been missed. The authors assessed the quality of the trials using reliable methods. Each stage of the review process was conducted in duplicate, minimising the potential for reviewer error and bias. Given that the trials were clinically and methodologically heterogeneous, a narrative synthesis was appropriate. However, the majority of trials included less than 100 patients, and only a small number of trials were included in each comparison, which may impact on the reliability of the review's findings.

This was a generally well-conducted review and the authors’ conclusions appear to reflect the evidence, but limitations with the included trials should be taken into consideration.

Implications of the review for practice and research
Practice: The authors stated that the findings can be used by nurses to inform their selection of warming interventions in perioperative nursing practice.

Research: The authors stated that future research should assess cutaneous warming systems in terms of the overall balance of costs, risks and benefits for patients, staff and healthcare organisations.

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Bibliographic details

PubMedID
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.