A systematic review of randomised controlled trials of the effects of warmed irrigation fluid on core body temperature during endoscopic surgeries

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CRD summary
The review concluded that warming of irrigation fluid significantly decreased the drop in core body temperature, risk of perioperative shivering and hypothermia in most types of endoscopic surgery. The authors’ overall conclusions seemed valid despite the low-quality evidence and heterogeneity in the surgery performed, site of measurement of body temperature and temperature and volume of warming fluids.

Authors’ objectives
To evaluate the effect of warming irrigation fluid compared to using room temperature irrigation fluid on core body temperature during endoscopic surgery.

Searching
PubMed, EMBASE, The Cochrane Library, SciELO, CAJ, Chinese Biomedical Literature Database, CSJD, Chinese Medical Association Journals were searched from inception to June 2009 for publications in English and Chinese; search terms were reported. SIGLE was searched for unpublished trials. The bibliography of each retrieved article and footnotes were handsearched.

Study selection
Randomised controlled trials (RCTs) that compared warmed irrigation fluid versus room temperature irrigation fluid used during any type of endoscopic surgery, with any type of anaesthesia, of patients of any age and gender with any disease were eligible for inclusion. Eligible studies had to measure at least one of the primary outcomes: incidence of perioperative hypothermia (≤36°C) or shivering; body temperature drop; time to regain initial temperature; and blood loss. The temperature of warmed irrigation fluid was defined as equal or near to body temperature.

Where described, equipment used to warm the irrigation fluid included an incubator, fluid warmer, heater, warming cabinet, hotline heater and a pressurised fluid warming system. The sites of body temperature measurement included rectal, oral, tympanic membrane and oesophageal. Endoscopic procedures included: transurethral resection of the prostate; hysteroscopic electric resection of the endometrium; minimally invasive percutaneous nephrolithotomy; laparoscopic surgery; and arthroscopic surgery. Anaesthesia used included spinal, general and epidural. Mean age ranged from 30 to 76.1 years in different patient groups.

The temperature of the warmed irrigation fluid ranged from 33°C to 40°C and for controls ranged from 20°C to 27°C. Where reported, the mean total volume of irrigation fluid used ranged from 9.8mL to 39,800mL in the intervention group and 10.3mL to 23,500mL in the control group. Mean surgery time ranged from 30 to 96.8 minutes in the intervention group and 37.6 to 102.2 minutes in the control group.

Two independent reviewers performed the selection.

Assessment of study quality
Methodological quality was assessed by two reviewers independently using criteria suggested in the Cochrane Library Handbook. Criteria included random sequence generation, allocation concealment, blinding of participants, incomplete outcome data, selective outcome reporting and other potential threats to validity. No scoring or grading system was used. Disagreements were resolved by discussion or by contacting original authors for further detailed information.

Data extraction
The number of events for each outcome was extracted to calculate odds ratio (OR) and 95% confidence intervals (CI). Continuous data were extracted as mean differences (MD) with 95% CI.
Two independent reviewers performed the extraction using a data extraction checklist. Disagreements were resolved by discussion, contacting the original authors for further information or by discussion with a third reviewer.

Methods of synthesis
Study results were pooled to give odds ratios for dichotomous data or weighted mean differences (WMD) or standardised mean differences for continuous data, all with 95% CIs. A fixed-effect model was used except where there was significant heterogeneity, in which case a random-effects model was used. Between-study heterogeneity was determined using $X^2$ and $I^2$ ($I^2 \geq 50\%$ indicated significant heterogeneity). Sensitivity analyses were performed where deemed appropriate.

Results of the review
Thirteen RCTs were identified (686 participants, range 20 to 80). Sequence generation was unclear in nine studies. Two studies were single-blind, one was double-blind, one was observer blind and in other studies blinding was unclear. Three studies had incomplete outcome data. Allocation concealment, selective outcome reporting and other potential threats to validity were unclear in all studies. There were discrepancies between text and tables/figures; results here were reported in the tables/figures.

Nine of out of ten studies individually showed a significantly greater perioperative body temperature drop for room temperature fluid than for warmed fluid. There was significant heterogeneity ($I^2=87\%$), so the authors did not report the overall standardised mean difference.

Incidence of perioperative shivering was significantly higher in the room temperature fluid group versus the warmed fluid group (OR 5.13, 95% CI 2.59 to 10.19, $I^2=0\%$; five studies). Incidence of perioperative hypothermia was significantly higher in the room temperature fluid group versus the warmed fluid group (OR 20.01, 95% CI 2.03 to 197.08, $I^2=64\%$; three studies).

There was significantly lower intraoperative blood loss in the warmed fluid group versus the room temperature group (WMD 15.54mL, 95% CI 6.67 to 24.41, $I^2=0\%$; three studies).

One study measured the time taken to regain baseline temperature and found a significant benefit for the warmed fluid group when temperature was measured rectally ($p=0.04$). The effect was not significant when measured orally ($p=0.07$).

None of the studies reported significant negative side effects. A sensitivity analysis was reported. The authors recorded which other outcomes were reported in the studies, but did not provide relevant data.

Authors’ conclusions
In endoscopic surgery, irrigation fluid is recommended to be warmed to decrease the drop in core body temperature, the risk of perioperative shivering and hypothermia.

CRD commentary
The review addressed a well-defined question in terms of participants, interventions, study design and relevant outcomes. Relevant databases were searched. Unpublished studies were considered. Only studies published in English and Chinese were included, so some relevant studies may have been missed. Study quality was assessed using suitable criteria. The studies were generally found not to be of high quality. Efforts were made to reduce error and bias throughout the review process. Relevant study details were reported. Statistical heterogeneity was assessed and there was evidence for heterogeneity for some outcomes.

Statistical methods used for meta-analysis of the RCTs seemed appropriate. The authors chose not to report the pooled result for the main outcome due to a high level of heterogeneity. One relevant sensitivity analysis was performed. There was a high degree of heterogeneity in the surgery performed, sites of body temperature measurement, temperature and volume of warming fluids and supplementary methods used to warm patients. Most studies were small. The overall number of patients was small.

The authors’ overall conclusions seem valid despite the low quality of the evidence and high degree of heterogeneity.
Implications of the review for practice and research

**Practice**: The authors stated that warming irrigation fluids should be standard practice in all endoscopic surgery. Awareness should be increased of the importance of intraoperative temperature management in all surgical specialities.

**Research**: The authors identified a need for well-designed double-blind RCTs with large sample sizes to verify their findings. They recommended research to develop non-invasive and unified temperature monitoring devices for core temperature. Research was also required to establish whether or not older patients exhibited more pronounced and prolonged hypothermia.

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