TEMPERATURE

Perioperative Hypothermia and Hyperthermia

Intraoperative teaching · CA-1

THE QUESTION

Where the evidence disagrees

This topic was selected because an evidence synthesis beats a textbook on it: the trials disagree, or the guidance has moved recently.

THE EVIDENCE

What each source contributes, and how strong it is

Study design first — a cohort and a randomised trial do not carry the same weight.

Design	Year	Journal	What it found
Other	2000	Anesthesiology	Core temperature falls in three phases under general anaesthesia - a rapid ear
Other	1995	Journal of Clinical Anesthesia	Warming the skin before induction is the manoeuvre that works against redistri
Other	1996	New England Journal of Medicine	Mild hypothermia is not a comfort issue
Other	2016	Cochrane Database of Systematic Re	Active surface warming earns its place - in a Cochrane review it reduced surgi
Other	2006	Anesthesiology Clinics	A cold operating room makes hypothermia the ordinary perioperative outcome, bu
Other	2010	Anesthesia and Analgesia	Malignant hyperthermia usually announces itself as hypercarbia, sinus tachycar

8 resolved citations behind this deck; every point above traces to one of them.

IN PRACTICE

What the cohorts and reviews add

6 findings, each on the slide that follows.

ANESTHESIOLOGY 2000

Core temperature falls in three phases under general anaesthesia - a rapid ear

Core temperature falls in three phases under general anaesthesia - a rapid early drop caused by internal redistribution of heat from core to…

JOURNAL OF CLINICAL ANESTHESIA 1995

Warming the skin before induction is the manoeuvre that works against redistri

Warming the skin before induction is the manoeuvre that works against redistribution, because redistribution hypothermia is otherwise difficult to…

NEW ENGLAND JOURNAL OF MEDICINE 1996

Mild hypothermia is not a comfort issue

Mild hypothermia is not a comfort issue: patients allowed to finish colorectal surgery at 34.7 degrees rather than 36.6 had surgical wound infections…

COCHRANE DATABASE OF SYSTEMATIC REVIEWS 2016

Active surface warming earns its place - in a Cochrane review it reduced surgi

Active surface warming earns its place - in a Cochrane review it reduced surgical site infection and cut shivering by about 60 per cent against no…

IN PRACTICE

Core temperature falls in three phases under general anaesthesia - a rapid ear

Other · Anesthesiology

Core temperature falls in three phases under general anaesthesia - a rapid early drop caused by internal redistribution of heat from core to periphery once anaesthetics abolish the tonic vasoconstriction that maintains the core-to-peripheral

gradient, then a slow linear decline set by heat loss exceeding production, then a plateau - and the same redistribution happens under neuraxial block, though restricted to the legs and so roughly half as large.

Sessler, Anesthesiology 2000 · PMID 10691247

IN PRACTICE

Warming the skin before induction is the manoeuvre that works against redistri

Other · Journal of Clinical Anesthesia

Warming the skin before induction is the manoeuvre that works against redistribution, because redistribution hypothermia is otherwise difficult to treat once it has happened: one hour of preinduction forced-air warming halved the rate of core cooling in the first hour of anaesthesia, from 1.1 to 0.6 degrees per hour, and left six of eight patients at or above 36.5 degrees where only one of eight controls was.

Camus et al., Journal of Clinical Anesthesia 1995 · PMID 7576673

IN PRACTICE

Mild hypothermia is not a comfort issue

Other · New England Journal of Medicine

Mild hypothermia is not a comfort issue: patients allowed to finish colorectal surgery at 34.7 degrees rather than 36.6 had surgical wound infections in 19 per cent of cases against 6 per cent, and stayed in hospital about 2.6 days longer, while a meta-analysis found that less than one degree of hypothermia raised surgical blood loss by roughly 16 per cent and the relative risk of transfusion by about 22 per cent.

Kurz et al., New England Journal of Medicine 1996 · PMID 8606715

IN PRACTICE

Active surface warming earns its place - in a Cochrane review it reduced surgi

Other · Cochrane Database of Systematic Re

Active surface warming earns its place - in a Cochrane review it reduced surgical site infection and cut shivering by about 60 per cent against no active warming - but warming harder is not warming better, because aggressive warming to 37 degrees produced no advantage over routine management at 35.5 degrees for myocardial injury, cardiac arrest or death in 5013 non-cardiac surgical patients.

Madrid et al., Cochrane Database of Systematic Reviews 2016 · PMID 27098439

IN PRACTICE

A cold operating room makes hypothermia the ordinary perioperative outcome, bu

Other · Anesthesiology Clinics

A cold operating room makes hypothermia the ordinary perioperative outcome, but hyperthermia is the more dangerous deviation and demands an immediate diagnosis rather than a reflex reach for the warmer's off switch - which is also why the site you monitor matters, oesophageal, nasopharyngeal, bladder and rectal sites being the ones that reflect core temperature intraoperatively.

Insler and Sessler, Anesthesiology Clinics 2006 · PMID 17342966

IN PRACTICE

Malignant hyperthermia usually announces itself as hypercarbia, sinus tachycar

Other · Anesthesia and Analgesia

Malignant hyperthermia usually announces itself as hypercarbia, sinus tachycardia or masseter spasm rather than as fever, with temperature among the first three signs in 63.5 per cent of 286 registry episodes, and delay costs measurably: the odds of a complication rose about 1.6 times for every 30-minute delay in giving dantrolene and about 2.9 times for every 2 degrees of maximum temperature reached.

Larach et al., Anesthesia and Analgesia 2010 · PMID 20081135

IN THE ROOM

What this changes about the next case

Colour is the strength of the evidence behind each step, not the urgency.

1. **1**
   Core temperature falls in three phases under general anaesthesia - a rapid early drop caused by internal redistribution of heat from core to periphery once anaesthetics abolish the tonic vasoconstriction that maintains the core-to-peripheral gradient, then a slow linear decline set by heat loss exceeding production, then a plateau - and the same redistribution happens under neuraxial block, though restricted to the legs and so roughly half as large.
2. **2**
   Warming the skin before induction is the manoeuvre that works against redistribution, because redistribution hypothermia is otherwise difficult to treat once it has happened: one hour of preinduction forced-air warming halved the rate of core cooling in the first hour of anaesthesia, from 1.1 to 0.6 degrees per hour, and left six of eight patients at or above 36.5 degrees where only one of eight controls was.

3 **3**

Mild hypothermia is not a comfort issue: patients allowed to finish colorectal surgery at 34.7 degrees rather than 36.6 had surgical wound infections in 19 per cent of cases against 6 per cent, and stayed in hospital about 2.6 days longer, while a meta-analysis found that less than one degree of hypothermia raised surgical blood loss by roughly 16 per cent and the relative risk of transfusion by about 22 per cent.

4 **4**

Active surface warming earns its place - in a Cochrane review it reduced surgical site infection and cut shivering by about 60 per cent against no active warming - but warming harder is not warming better, because aggressive warming to 37 degrees produced no advantage over routine management at 35.5 degrees for myocardial injury, cardiac arrest or death in 5013 non-cardiac surgical patients.

5 **5**

A cold operating room makes hypothermia the ordinary perioperative outcome, but hyperthermia is the more dangerous deviation and demands an immediate diagnosis rather than a reflex reach for the warmer's off switch - which is also why the site you monitor matters, oesophageal, nasopharyngeal, bladder and rectal sites being the ones that reflect core temperature intraoperatively.

KEY TAKEAWAYS

What to carry into the next case

Core temperature falls in three phases under general anaesthesia - a rapid ear
Anesthesiology 2000

Warming the skin before induction is the manoeuvre that works against redistri
Journal of Clinical Anesthesia 1995

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New England Journal of Medicine 1996

Active surface warming earns its place - in a Cochrane review it reduced surgi
Cochrane Database of Systematic Reviews 2016

Most of the heat a patient loses in the first hour was never lost at all - it was redistributed from a warm core to a cold periphery the moment anaesthesia abolished vasoconstriction - which is why the only effective treatment is warming that happened before induction, and why a temperature going the other way is the more urgent problem.

QUESTIONS I'LL ASK YOU IN THE ROOM

1. He dropped 1.6 degrees in 45 minutes with the room at 20 degrees. Where did that heat actually go?
2. What would you have done in the holding area, and how long would it have needed to run?
3. Name three complications of letting him sit at 35 degrees for three hours, and tell me which one you could measure today.
4. The temperature is now 38.3 with a rising carbon dioxide. What is on your list, what do you do first, and where in this hospital is the dantrolene?

ORAL BOARDS STEM

A 68-year-old man is having an open sigmoid colectomy expected to take three hours. He is prepped and draped before you look at the temperature: the oesophageal probe reads 35.2 degrees at 45 minutes, having been 36.8 in the holding area. Two hours later, with the forced-air blanket running on high, the same probe reads 38.3 and his end-tidal carbon dioxide has risen from 36 to 51 mmHg despite the minute ventilation being unchanged. Take the first problem and then the second: why did he get cold, what would have prevented it, and what is your differential now that he is hot?

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SOURCES

[1] Sessler, Anesthesiology 2000 · PMID 10691247
[2] Camus et al., Journal of Clinical Anesthesia 1995 · PMID 7576673
[3] Kurz et al., New England Journal of Medicine 1996 · PMID 8606715
[4] Rajagopalan et al., Anesthesiology 2008 · PMID 18156884
[5] Madrid et al., Cochrane Database of Systematic Reviews 2016 · PMID 27098439
[6] Sessler et al., The Lancet 2022 · PMID 35390321
[7] Insler and Sessler, Anesthesiology Clinics 2006 · PMID 17342966

[8] Larach et al., Anesthesia and Analgesia 2010 · PMID 20081135