

Temperature control to improve neurological outcomes after cardiac arrest

Interventional procedures guidance

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Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account, and specifically any special arrangements relating to the introduction of new interventional procedures. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the [Yellow Card Scheme](#).

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful

discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties. Providers should ensure that governance structures are in place to review, authorise and monitor the introduction of new devices and procedures.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

1 Recommendations

To prevent fever

- 1.1 Use temperature control as an option to prevent fever and improve neurological outcomes after cardiac arrest with standard arrangements in place for clinical governance, consent and audit.
- 1.2 For auditing the outcomes of this procedure, the main efficacy and safety outcomes identified in this guidance can be entered into NICE's interventional procedure outcomes audit tool (for use at local discretion).

To induce therapeutic hypothermia

- 1.3 More research is needed on temperature control to induce therapeutic hypothermia (a temperature of less than 36°C) to improve neurological outcomes after cardiac arrest.
- 1.4 This procedure should only be done as part of a formal research study and a research ethics committee needs to have approved its use.
- 1.5 More research, in the form of randomised controlled trials, is needed on:
 - patient selection
 - timing of the intervention
 - degree and duration of temperature control

- neurological outcomes
- survival.

Why the committee made these recommendations

Clinical trial evidence suggests that, if core body temperature is controlled to prevent fever after cardiac arrest, there may be improved neurological outcomes (less brain injury). There are no safety concerns with fever prevention. So, it can be used with standard arrangements. But more research is needed on whether the improved neurological outcomes are directly related to the procedure.

Some clinical trial evidence suggests that there is less brain injury when the body's core temperature is cooled to below 36°C (therapeutic hypothermia) after cardiac arrest. But other clinical trial evidence suggests that there is no reduction in brain injury. In some trials, the procedure was delayed. So, the importance of how long after cardiac arrest cooling is started is uncertain.

Evidence on the safety of therapeutic hypothermia suggests that it is potentially harmful. People who have this procedure are also more likely to have an abnormal heart rhythm. More research is needed on safety and long-term outcomes of therapeutic hypothermia after cardiac arrest, so it should be used only in research.

2 The condition, current treatments and procedure

The condition

2.1 Cardiac arrest is when normal blood circulation suddenly stops because the heart fails to contract effectively. The underlying abnormal cardiac rhythms most commonly associated with cardiac arrest are:

- ventricular fibrillation (VF)

- asystole
- pulseless electrical activity
- pulseless ventricular tachycardia (VT).

Cardiac arrest leads to loss of consciousness, respiratory failure and, ultimately, death.

Current treatments

- 2.2 Treatment for cardiac arrest includes immediate cardiopulmonary resuscitation to restore the circulation and prevent subsequent brain injury. Defibrillation may be used to treat VF and pulseless VT rhythms. Standard care may also include mechanical ventilation and drugs such as adrenaline and amiodarone. [Resuscitation Council UK's 2021 resuscitation guidelines](#) contain guidance on basic and advanced life support.

The procedure

- 2.3 After cardiac arrest, people in a coma who have a return of spontaneous circulation (ROSC) can have their core body temperature actively controlled. This is done to:
- prevent fever (by maintaining a core temperature between 36.5°C and 37.5°C), or
 - induce therapeutic hypothermia (by cooling to a core temperature typically between 32°C and 36°C).
- 2.4 The aim is to reduce brain injury and improve neurological outcomes. The exact mechanism by which cooling may protect against brain injury is unclear. Possible mechanisms include reductions in metabolic demand, release of excitatory neurotransmitters and inflammation after ischaemia.

2.5 Temperature control is done using either:

- surface techniques (for example, heat exchange cooling pads, cooling blankets and ice packs), or
- internal techniques (for example, an endovascular cooling device).

Core body temperature is monitored using a temperature probe (such as a bladder, rectal or nasopharyngeal temperature probe) and is controlled to a preset point determined by the clinician.

2.6 If therapeutic hypothermia is induced, controlled rewarming is usually done over several hours. In addition, people who have had cardiac arrest generally have standard critical care measures, and may need intravenous sedation and muscle relaxants, to prevent shivering.

3 Committee considerations

The evidence

3.1 NICE did a rapid review of the published literature on the efficacy and safety of this procedure. This comprised a comprehensive literature search and detailed review of the evidence from 9 sources, which was discussed by the committee. The evidence included 8 systematic reviews and meta-analyses and 1 randomised controlled trial (RCT). It is presented in the [summary of key evidence section in the interventional procedures overview](#). Other relevant literature is in the appendix of the overview.

3.2 The professional experts and the committee considered the key efficacy outcomes to be:

- survival
- reduction in long-term neurological disability
- independent living

- quality of life
- reduction in length of critical care and hospital stay.

3.3 The professional experts and the committee considered the key safety outcomes to be:

- arrhythmias
- shivering
- pneumonia
- sepsis
- skin damage.

3.4 Patient commentary was sought but none was received.

Committee comments

3.5 There are several available technologies for controlling temperature after cardiac arrest.

3.6 Using large volumes of intravenous saline to induce therapeutic hypothermia before admission to hospital can cause side effects such as pulmonary oedema.

3.7 The committee was informed that additional RCTs comparing temperature control for fever prevention with no intervention are unlikely to be done.

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Endorsing organisation

This guidance has been endorsed by [Healthcare Improvement Scotland](#).

Accreditation

