

# Therapeutic hypothermia following cardiac arrest

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**NICE interventional procedure guidance 386**

[www.nice.org.uk/ipg386](http://www.nice.org.uk/ipg386)

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## 1 Guidance

- 1.1 Current evidence on the safety and efficacy of therapeutic hypothermia following cardiac arrest is adequate to support the use of this procedure provided that normal arrangements are in place for clinical governance, audit and consent.

## 2 The procedure

### 2.1 Indications and current treatments

- 2.1.1 Cardiac arrest leads to loss of consciousness and death unless emergency resuscitation is given and the heart can be restarted. The abnormal cardiac rhythms most commonly associated with cardiac arrest are asystole, pulseless electrical activity, ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT).
- 2.1.2 Brain injury following cardiac arrest may be prevented by early cardiopulmonary resuscitation, including defibrillation to treat VF and pulseless VT rhythms. Drugs such as adrenaline are also commonly required.

### 2.2 Outline of the procedure

- 2.2.1 After cardiac arrest, comatose patients who have a return of spontaneous circulation (ROSC) can be cooled to a core temperature of 32–34°C with the aim of reducing brain injury and improving neurological outcome. The exact mechanism by which cooling confers cerebral protection is unknown.
- 2.2.2 As soon as possible after the cardiac arrest, mild hypothermia is induced by using surface techniques (for example heat exchange cooling pads, cooling blankets, ice packs), internal techniques (for example an endovascular cooling device) or a combination of cooling methods. Core body temperature is maintained at 32–34°C for 12–24 hours from the start of cooling and is monitored using a bladder temperature probe. Controlled re-warming is usually done over a number of hours. In addition to cooling, patients generally receive standard critical care measures, together with intravenous sedation and muscle relaxants (to prevent shivering).

Sections 2.3 and 2.4 describe efficacy and safety outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [overview](#).

## 2.3 Efficacy

- 2.3.1 A systematic review of 481 patients reported that a significantly higher proportion of patients who had therapeutic hypothermia survived to hospital discharge compared with patients in the standard care group (risk ratio [RR] 1.35, 95% confidence interval [CI] 1.10 to 1.65, 3 studies).
- 2.3.2 The systematic review of 481 patients reported that a significantly higher proportion of patients in the hypothermia group had a good neurological outcome at hospital discharge compared with patients in the standard care group (RR 1.55, 95% CI 1.24 to 1.94, 5 studies).
- 2.3.3 A randomised controlled trial (RCT) of 275 patients (137 hypothermia vs 138 normothermia) reported a significantly higher proportion of patients in the hypothermia group with a favourable neurological outcome at 6 months compared with patients in the normothermia group, after adjusting for baseline variables (RR 1.47, 95% CI 1.09 to 1.82).
- 2.3.4 An RCT of 54 patients (36 hypothermia vs 18 normothermia) reported that a significantly higher proportion of patients in the hypothermia group had a good neurological outcome at 1 month compared with patients in the normothermia group (50% vs 11%,  $p < 0.05$ ).
- 2.3.5 The Specialist Advisers listed key efficacy outcomes as survival, reduced long-term neurological disability, independent living, quality of life (SF-36, Health Utility Index 3), and reductions in length of critical care and hospital stay.

## 2.4 Safety

- 2.4.1 A case series of 986 patients reported sepsis and pneumonia rates of 4% (35/986) and 41% (407/986) respectively. The systematic review of 481 patients reported higher rates of pneumonia and sepsis in the hypothermia group compared with patients in the standard care group but the differences were not significant (pneumonia: RR 1.27, 95% CI 0.90 to 1.78, 1 study; sepsis: RR 1.93, 95% CI 0.89 to 1.78, 1 study).

- 2.4.2 The systematic review of 481 patients reported numerically higher rates of hypophosphataemia (abnormally low level of phosphate in the blood which can cause muscle weakness, respiratory problems and changes in mental state) in the hypothermia group compared with standard care but the differences were not significant (RR 1.12, 95% CI 0.65 to 2.25, 1 study).
- 2.4.3 An RCT of 61 patients (20 haemofiltration only vs 22 hypothermia plus haemofiltration vs 19 controls) reported similar 6-month hypokalaemia rates of 25% (5/20) in the haemofiltration only group and 23% (5/22) in the hypothermia plus haemofiltration group. The same study reported similar 6-month hypophosphataemia rates of 45% (9/20) in the haemofiltration only group and 55% (12/22) in the hypothermia plus haemofiltration group.
- 2.4.4 The systematic review of 481 patients reported a numerically higher rate of bleeding requiring platelet transfusion in the hypothermia group compared with standard care but the difference was not significant (RR 5.11, 95% CI 0.25 to 5.47, 1 study).
- 2.4.5 An RCT of 64 patients (34 hypothermia using gel pads with feedback control vs 30 hypothermia using blankets and ice) reported heparin-induced thrombocytopenia within 90 days in 1 patient in the gel pads with feedback control group and no patients in the blankets and ice group. The same study reported 2 patients with a gastrointestinal bleed within 90 days in the blankets and ice group and no patients in the gel pads group.
- 2.4.6 A case series of 986 patients reported bleeding requiring transfusion in 5% (44/986) of patients.
- 2.4.7 The RCT of 64 patients reported similar 90-day seizure and/or status epilepticus rates in both groups (19% [6/32] vs 17% [5/29]).
- 2.4.8 The systematic review of 481 patients reported a higher rate of lethal or long lasting arrhythmias in the hypothermia group compared with standard care but the differences were not significant (RR 1.21, 95% CI 0.88 to 1.67, 1 study).

- 2.4.9 The Specialist Advisers listed anecdotal adverse events as coagulation and immune modulation due to overcooling, thermal injury to skin from cooling devices, arrhythmias, secondary infections, shivering, electrolyte imbalance, pancreatitis, peripheral vasoconstriction and thrombosis related to endovascular devices. They considered theoretical adverse events to include ileus, hepatic failure and renal failure.

## 2.5 Other comments

- 2.5.1 The Committee noted that the majority of evidence was on patients with ventricular fibrillation arrest and continuing loss of consciousness. Evidence on other patients is limited.
- 2.5.2 The Committee also noted that while this procedure is efficacious in some patients, the outcomes are variable and unpredictable.

## 3 Further information

3.1 For related NICE guidance see our [website](#).

### Information for patients

NICE has produced [information on this procedure for patients and carers](#) ('Understanding NICE guidance'). It explains the nature of the procedure and the guidance issued by NICE, and has been written with patient consent in mind.

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## 4 About this guidance

NICE interventional procedure guidance makes recommendations on the safety and efficacy of the procedure. It does not cover whether or not the NHS should fund a procedure. Funding decisions are taken by local NHS bodies after considering the clinical effectiveness of the procedure and whether it represents value for money for the NHS. It is for healthcare professionals and people using the NHS in England, Wales, Scotland and Northern Ireland, and is endorsed by Healthcare Improvement Scotland for implementation by NHSScotland.

This guidance was developed using the NICE [interventional procedure guidance](#) process.

We have produced a [summary of this guidance for patients and carers](#). Information about the evidence it is based on is also [available](#).

### Changes since publication

2 January 2012: minor maintenance.

### Your responsibility

This guidance represents the views of NICE and was arrived at after careful consideration of the available evidence. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. This guidance does not, however, override the individual responsibility of healthcare professionals to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way which would be inconsistent with compliance with those duties.

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### **Contact NICE**

National Institute for Health and Clinical Excellence  
Level 1A, City Tower, Piccadilly Plaza, Manchester M1 4BT

[www.nice.org.uk](http://www.nice.org.uk)

[nice@nice.org.uk](mailto:nice@nice.org.uk)

0845 033 7780