

EDITORIALS

Severe accidental hypothermia

Few UK emergency departments have a hypothermia protocol. This must change

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“Failure to prepare is preparing to fail” (Benjamin Franklin)

Rarely, does a British winter go by without a headline such as “Stranded climber dies from hypothermia.” Despite the media focus, only about five cases of severe hypothermia occur each year on British mountains. Hypothermia is more common in urban areas and was an important factor in the deaths of 166 people in the United Kingdom in 2012. In these cases, other factors often included alcohol intoxication, drug overdose, and mental illness.

Although cardiopulmonary bypass, and more recently extracorporeal membrane oxygenation (ECMO), have been used in many countries since the late 1960s to rewarm people with hypothermic cardiac arrest,^{1,2} these techniques have rarely been used for this purpose in the UK.³ In the 1990s, several papers were published on the successful use of cardiopulmonary bypass to rewarm patients with hypothermic cardiac arrest. In 2005, the European Resuscitation Council (ERC) guidelines recognised this technique as the preferred method of active rewarming in hypothermic cardiac arrest. The remarkable survival of a patient from a core temperature of 13.7°C showed what is possible.⁴

The phrase “not dead until warm and dead” is well known and often quoted as a guiding principle. Management has improved internationally, but can the same be said for the UK? Few British hospitals have a hypothermia protocol, and with limited availability of ECMO and cardiopulmonary bypass and little integration between the prehospital and hospital phases of care, a streamlined pathway to the appropriate facility has never been established in this country.

Severely hypothermic patients with cardiac stability can be externally or minimally invasively rewarmed with an almost 100% chance of success. For those in cardiac arrest, the growing evidence base has produced greater awareness of the problems related to diagnosis and treatment. The 2010 ERC guidelines identified ECMO and cardiopulmonary bypass as important

modalities for rewarming patients,⁵ with an expected survival rate of around 50%.⁶ In a Danish case report series of seven patients with hypothermic cardiac arrest, the survival rate with ECMO was 100%.⁷ Survival rates are better with ECMO than with cardiopulmonary bypass, largely because it can provide continued support during acute respiratory distress syndrome, which often occurs after the return of spontaneous circulation.² However, cardiopulmonary bypass may be the only option in the UK because ECMO is not widely available, and capacity may be limited, particularly if there is a concurrent flu epidemic. The increased availability of mechanical cardiopulmonary resuscitation devices has improved the ability to maintain effective chest compression for hours during transport to a specialist centre,⁸ unlike manual resuscitation, which degrades rapidly.⁹

In the absence of signs of life, the key to appropriate case selection for extracorporeal rewarming is to identify patients in whom asystole was caused by hypothermia—“cold” hypoxia (and hence cerebral protection) rather than “warm” hypoxia due to asphyxia with subsequent hypothermia, as in drowning. Serum potassium may be used to differentiate between these two entities and for prognostication,^{6,10} especially in patients who have been involved in an avalanche, in whom warm hypoxia is more prevalent.¹¹

In the prehospital phase, the measurement of core temperature at the incident site may be impossible or unreliable. Therefore, many guidelines have moved to the Swiss staging of hypothermia, which relies on a situational awareness that hypothermia is possible, and an assessment of consciousness and the presence of vital signs (box).¹² Cooling during extrication and evacuation generally occurs and measures should be taken to prevent further heat loss with insulation and heat packs.^{6,12} Modern algorithms emphasise the importance of an early decision on the need for extracorporeal rewarming in patients with cardiac arrest, and the recognition that this might be needed in patients with cardiac instability (systolic blood pressure <90 mm Hg, ventricular arrhythmias, or core temperature <28°C).⁶

Adapted Swiss staging system of accidental hypothermia

- Stage I: clearly conscious and shivering (35-32°C)
- Stage II: impaired consciousness without shivering (32-28°C)
- Stage III: unconscious (28-24°C)
- Stage IV: minimal vital signs or apparent death (24-13.7°C)
- Stage V: death from irreversible hypothermia (<13.7°C)

To establish a successful chain of survival, a flexible pathway from the incident site to the rewarming facility must be agreed by the involved parties in advance. Flexibility is a key word. Each case will have unique geographical, chronological, meteorological, and human factors. Taking a patient with hypothermic cardiac arrest to the nearest emergency department could prevent transfer to definitive care and cost the patient his or her life. With the use of a mechanical cardiopulmonary resuscitation device, the extra time taken to transport the patient directly to an ECMO or cardiopulmonary bypass centre will not be a disadvantage. It is now standard practice in the UK to transfer patients with a suspected ST elevation myocardial infarction to the nearest hospital with a cardiac catheterisation laboratory rather than to the nearest hospital; a similar protocol is long overdue for patients with hypothermia. Such a protocol has been agreed, for instance, between the Lake District Search and Mountain Rescue Association and the ECMO team at the University Hospital of South Manchester.

As far as we are aware, no country has yet developed a national hypothermia protocol. Therefore, the onus is on individual prehospital and hospital clinical areas to work together to develop a protocol for their setting, which should include the following:

- Education to make sure that staff understand the problems and to prevent premature cessation of resuscitation
- Clear protocols to ensure smooth mobilisation of established treatments and maximise the likelihood of a successful outcome
- Involvement of cardiac centres to provide ECMO or cardiopulmonary bypass (find your local ECMO centre: www.else.med.umich.edu/Member.asp)
- Ability to phone the centre directly from the casualty site
- Preparedness of transport agencies to deliver the patient directly to a cardiac centre, thereby avoiding a secondary transfer
- Commitment to contribute to the International Hypothermia Registry (<https://www.hypothermia-registry.org/>) so that

experiences can be shared and the knowledge base needed to refine the management of these cases can be built up.

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