Part 10.4: Hypothermia

Unintentional hypothermia is a serious and preventable health problem. Severe hypothermia (body temperature <30°C [86°F]) is associated with marked depression of critical body functions that may make the victim appear clinically dead during the initial assessment. But in some cases hypothermia may exert a protective effect on the brain and organs in cardiac arrest.[1,2] Intact neurologic recovery may be possible after hypothermic cardiac arrest, although those with nonasphyxial arrest have a better prognosis than those with asphyxial-associated hypothermic arrest.[3–5] With this in mind, lifesaving procedures should not be withheld on the basis of clinical presentation.[4] Victims should be transported as soon as possible to a center where monitored rewarming is possible.

General Care for All Victims of Hypothermia

When the victim is extremely cold but has maintained a perfusing rhythm, the rescuer should focus on interventions that prevent further heat loss and begin to rewarm the victim. These include the following:

- Prevent additional evaporative heat loss by removing wet garments and insulating the victim from further environmental exposures.
- Do not delay urgent procedures, such as intubation and insertion of vascular catheters, but perform them gently while closely monitoring cardiac rhythm. These patients are prone to develop ventricular fibrillation (VF).

For patients with moderate to severe hypothermia, therapy is determined by the presence or absence of a perfusing rhythm. We provide an overview of therapy here and give more details below. Management of the patient with moderate to severe hypothermia is as follows:

- Hypothermia with a perfusing rhythm
  - –Mild (>34°C [>93.2°F]): passive rewarming
  - –Moderate (30°C to 34°C [86°F to 93.2°F]): active external rewarming
  - –Severe (<30°C [86°F]): active internal rewarming; consider extracorporeal membrane oxygenation
- Patients in cardiac arrest will require CPR with some modifications of conventional BLS and ACLS care and will require active internal rewarming
  - –Moderate (30°C to 34°C [86°F to 93.2°F]): start CPR, attempt defibrillation, establish IV access, give IV medications spaced at longer intervals, provide active internal rewarming
  - –Severe (<30°C [86°F]): start CPR, attempt defibrillation once, withhold medications until temperature >30°C (86°F), provide active internal rewarming
  - –Patients with a core temperature of >34°C (>93.2°F) may be passively rewarmed with warmed blankets and a warm environment. This form of rewarming will not be adequate for a patient with cardiopulmonary arrest or severe hypothermia.[6]
  - –For patients with moderate hypothermia (30°C to 34°C [86°F to 93.2°F]) and a perfusing rhythm and no preceding cardiac arrest, active external warming (with heating blankets, forced air, and warmed infusion) should be considered (Class IIb). Active external rewarming uses heating methods or devices (radiant heat, forced hot air, warmed IV fluids, warm water packs) but no invasive devices. Use of these methods requires careful monitoring for hemodynamic changes and tissue injury from external heating devices. Some researchers believe that active external rewarming contributes to "afterdrop" (continued drop in core temperature when cold blood from the periphery is mobilized). But recent studies have indicated that forced air rewarming (one study used warmed IV fluids and forced air rewarming) is effective in some patients, even those with severe hypothermia.[7,8]
  - –For patients with a core body temperature <30°C (86°F) and cardiac arrest, active internal rewarming techniques (invasive) are needed. With or without return of spontaneous circulation, these patients may benefit from prolonged CPR and internal warming (peritoneal lavage, esophageal rewarming tubes, cardiopulmonary bypass, extracorporeal circulation, etc).

Modifications of BLS for Hypothermia

If the hypothermic victim has not yet developed cardiac arrest, focus attention on warming the patient with available methods. Handle the victim gently for all procedures; physical manipulations have been reported to precipitate VF.[4,9]

If the hypothermic victim is in cardiac arrest, the general approach to BLS management should still target airway, breathing, and circulation but with some modifications in approach. When the victim is hypothermic, pulse and respiratory rates may be slow or difficult to detect. For these reasons the BLS healthcare provider should assess breathing and later assess the pulse for a period of 30 to 45 seconds to confirm respiratory arrest, pulseless cardiac arrest, or bradycardia that is profound enough to require CPR.[10] If the victim is not breathing, start rescue breathing immediately. If possible, administer warmed (42°C to 46°C [108°F to 115°F]) humidified oxygen during bag-mask ventilation. If the victim is pulseless with no detectable signs of circulation, start chest compressions immediately. If there is any doubt about whether a pulse is present, begin compressions.

The temperature at which defibrillation should first be attempted in the severely hypothermic patient and the number

(*Circulation.* 2005;112:IV-136-IV-138.)

This special supplement to *Circulation* is freely available at http://www.circulationaha.org

DOI: 10.1161/CIRCULATIONAHA.105.166566

of defibrillation attempts that should be made have not been established. But if ventricular tachycardia (VT) or VF is present, defibrillation should be attempted. Automated external defibrillators (AEDs) may be used for these patients. If VF is detected, it should be treated with 1 shock then immediately followed by resumption of CPR, as outlined elsewhere in these guidelines for VF/VT (see Part 5: "Electrical Therapies: Automated External Defibrillators, Defibrillation, Cardioversion, and Pacing"). If the patient does not respond to 1 shock, further defibrillation attempts should be deferred, and the rescuer should focus on continuing CPR and rewarming the patient to a range of 30°C to 32°C (86°F to 89.6°F) before repeating the defibrillation attempt. If core temperature is <30°C (86°F), successful conversion to normal sinus rhythm may not be possible until rewarming is accomplished.[11]

To prevent further core heat loss, remove wet garments and protect the victim from further environmental exposure. Insofar as possible this should be done while providing initial BLS therapies. Beyond these critical initial steps, the treatment of severe hypothermia (temperature <30°C [86°F]) in the field remains controversial. Many providers do not have the time or equipment to assess core body temperature or to institute aggressive rewarming techniques, although these methods should be initiated when available.[4,9,12,13]

Modifications to ACLS for Hypothermia

For unresponsive patients or those in arrest, endotracheal intubation is appropriate. Intubation serves 2 purposes in the management of hypothermia: it enables provision of effective ventilation with warm, humidified oxygen, and it can isolate the airway to reduce the likelihood of aspiration.

ACLS management of cardiac arrest due to hypothermia focuses on more aggressive active core rewarming techniques as the primary therapeutic modality. The hypothermic heart may be unresponsive to cardiovascular drugs, pacemaker stimulation, and defibrillation.[9] In addition, drug metabolism is reduced. There is concern that in the severely hypothermic victim, cardioactive medications can accumulate to toxic levels in the peripheral circulation if given repeatedly. For these reasons IV drugs are often withheld if the victim's core body temperature is <30°C (86°F). If the core body temperature is >30°C, IV medications may be administered but with increased intervals between doses.

As noted previously, a defibrillation attempt is appropriate if VF/VT is present. If the patient fails to respond to the initial defibrillation attempt or initial drug therapy, defer subsequent defibrillation attempts or additional boluses of medication until the core temperature rises above 30°C (86°F).[9] Sinus bradycardia may be physiologic in severe hypothermia (ie, appropriate to maintain sufficient oxygen delivery when hypothermia is present), and cardiac pacing is usually not indicated.

In-hospital treatment of severely hypothermic (core temperature <30°C [86°F]) victims in cardiac arrest should be directed at rapid core rewarming. Techniques for in-hospital controlled rewarming include administration of warmed, humidified oxygen (42°C to 46°C [108°F to 115°F]), warmed IV fluids (normal saline) at 43°C (109°F), peritoneal lavage with warmed fluids, pleural lavage with warm saline through chest tubes, extracorporeal blood warming with partial bypass,[4,9,12,14,15] and cardiopulmonary bypass.[16]

During rewarming, patients who have been hypothermic for >45 to 60 minutes are likely to require volume administration because the vascular space expands with vasodilation. Routine administration of steroids, barbiturates, and antibiotics has not been documented to increase survival rates or decrease postresuscitation damage.[17,18]

If drowning preceded hypothermia, successful resuscitation is unlikely. Because severe hypothermia is frequently preceded by other disorders (eg, drug overdose, alcohol use, or trauma), the clinician must look for and treat these underlying conditions while simultaneously treating the hypothermia.

Withholding and Cessation of Resuscitative Efforts

In the field resuscitation may be withheld if the victim has obvious lethal injuries or if the body is frozen so that nose and mouth are blocked by ice and chest compression is impossible.[19]

Some clinicians believe that patients who appear dead after prolonged exposure to cold temperatures should not be considered dead until they are warmed to near normal core temperature.[10,11] Hypothermia may exert a protective effect on the brain and organs if the hypothermia develops rapidly in victims of cardiac arrest. When a victim of hypothermia is discovered, however, it may be impossible to distinguish primary from secondary hypothermia. When it is clinically impossible to know whether the arrest or the hypothermia occurred first, rescuers should try to stabilize the patient with CPR. Basic maneuvers to limit heat loss and begin rewarming should be started. Once the patient is in the hospital, physicians should use their clinical judgment to decide when resuscitative efforts should cease in a victim of hypothermic arrest.

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