

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION



Part 17: First Aid: 2010 American Heart Association and American Red Cross Guidelines for First Aid

David Markenson, Jeffrey D. Ferguson, Leon Chameides, Pascal Cassan, Kin-Lai Chung, Jonathan Epstein, Louis Gonzales, Rita Ann Herrington, Jeffrey L. Pellegrino, Norda Ratcliff and Adam Singer

Circulation 2010;122;S934-S946

DOI: 10.1161/CIRCULATIONAHA.110.971150

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75214

Copyright © 2010 American Heart Association. All rights reserved. Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

http://circ.ahajournals.org/cgi/content/full/122/18_suppl_3/S934

An erratum has been published regarding this article. Please see the attached page or:

<http://circ.ahajournals.org/cgi/content/full/122/21/2228>

Subscriptions: Information about subscribing to *Circulation* is online at
<http://circ.ahajournals.org/subscriptions/>

Permissions: Permissions & Rights Desk, Lippincott Williams & Wilkins, a division of Wolters Kluwer Health, 351 West Camden Street, Baltimore, MD 21202-2436. Phone: 410-528-4050. Fax: 410-528-8550. E-mail:
journalpermissions@lww.com

Reprints: Information about reprints can be found online at
<http://www.lww.com/reprints>

Part 17: First Aid

2010 American Heart Association and American Red Cross Guidelines for First Aid

David Markenson, Co-Chair*; Jeffrey D. Ferguson, Co-Chair*; Leon Chameides; Pascal Cassan; Kin-Lai Chung; Jonathan Epstein; Louis Gonzales; Rita Ann Herrington; Jeffrey L. Pellegrino; Norda Ratcliff; Adam Singer

The American Heart Association (AHA) and the American Red Cross (Red Cross) cofounded the National First Aid Science Advisory Board to review and evaluate the scientific literature on first aid in preparation for the 2005 *American Heart Association (AHA) and American Red Cross Guidelines for First Aid*.¹ In preparation for the 2010 evidence evaluation process, the National First Aid Advisory Board was expanded to become the International First Aid Science Advisory Board with the addition of representatives from a number of international first aid organizations (see Table). The goal of the board is to reduce morbidity and mortality due to emergency events by making treatment recommendations based on an analysis of the scientific evidence that answers the following questions:

- In which emergency conditions can morbidity or mortality be reduced by the intervention of a first aid provider?
- How strong is the scientific evidence that interventions performed by a first aid provider are safe, effective, and feasible?

A critical review of the scientific literature by members of the International First Aid Science Advisory Board is summarized in the 2010 *International Consensus on First Aid Science With Treatment Recommendations (ILCOR 2010 CPR Consensus)*, from which these guidelines are derived.² That critical review evaluates the literature and identifies knowledge gaps that might be filled through future scientific research.

Background

The history of first aid can be traced to the dawn of organized human societies. For example, Native American Sioux medicine men of the Bear Society were noted for treating battle injuries, fixing fractures, controlling bleeding, removing arrows, and using a sharp flint to cut around wounds and inflammation.³

Modern, organized first aid evolved from military experiences when surgeons taught soldiers how to splint and bandage battlefield wounds. Two British officers, Peter Shepherd and Francis Duncan, are said to have been the first to expand the concept to civilians and to develop the first curriculum in first aid.⁴ Organized training in civilian first aid began in the United States in 1903 when Clara Barton, president of the Red Cross, formed a committee to establish instruction in first aid among the nation's industrial workers, where, under dangerous conditions, accidents and deaths were all too frequent.

The Evidence Evaluation Process

The International First Aid Science Advisory Board first identified 38 questions in first aid practice that either were not raised in previous evidence evaluations or were in need of updating. Two or more board members volunteered to review the scientific literature independently and develop an evidence-based review worksheet summarizing the literature relevant to each question (see Part 2: "Evidence Evaluation and Management of Potential or Perceived Conflicts of Interest"). After each worksheet was presented to, and reviewed by, the full board, a summary draft of the scientific evidence and a treatment recommendation were crafted. The evidence-based review for each question was presented and discussed a second time at a subsequent board meeting. All first aid worksheets, co-copyrighted by the American Heart Association and the American Red Cross, can be viewed through hyperlinks in the 2010 American Heart Association and American Red Cross International Consensus on First Aid Science with Treatment Recommendations.² Each question, evidence-based review, draft summary of science, and draft treatment recommendation was presented, discussed, and debated on 2 separate occasions until a consensus was reached. These guidelines are based on the scientific consensus findings reported in the 2010 *International Consensus on First Aid Science with Treatment Recommendations*.²

The American Heart Association and the American Red Cross request that this document be cited as follows: Markenson D, Ferguson JD, Chameides L, Cassan P, Chung K-L, Epstein J, Gonzales L, Herrington RA, Pellegrino JL, Ratcliff N, Singer A. Part 17: first aid: 2010 American Heart Association and American Red Cross Guidelines for First Aid. *Circulation*. 2010;122(suppl 3):S934–S946.

*Co-chairs and equal first co-authors.

(*Circulation*. 2010;122[suppl 3]:S934–S946.)

© 2010 American Heart Association, Inc., and American Red Cross.

Circulation is available at <http://circ.ahajournals.org>

DOI: 10.1161/CIRCULATIONAHA.110.971150

Table. International First Aid Science Advisory Board Member Organizations

American Academy of Pediatrics
American Burn Association
American College of Emergency Physicians
American College of Occupational and Environmental Medicine
American College of Surgeons
American Heart Association
American Pediatric Surgical Association
American Red Cross
American Red Cross Advisory Council on First Aid, Aquatics, Safety and Preparedness (ACFASP)
American Safety & Health Institute (ASHI)
Austrian Red Cross
Canadian Red Cross
Divers Alert Network
European Reference Center on First Aid Education
Egyptian Red Crescent
French Red Cross
Grenada Red Cross
Hong Kong Red Cross
Hungarian Red Cross
International Federation of Red Cross and Red Crescent Societies
Medic First Aid International
National Association of EMS Educators
National Association of EMS Physicians
National Athletic Trainers' Association
National Safety Council
Norwegian Red Cross
Occupational Safety and Health Administration
Red Cross Society of China
Resuscitation Council of Asia
St. John Ambulance, UK

Previous reports^{5–8} have noted the paucity of scientific evidence supporting many interventions in prehospital emergency care. In reviewing the medical literature, members of the International First Aid Science Advisory Board once again found a paucity of evidence to guide first aid interventions. Very little research is being conducted in first aid, and many of the following recommendations are extrapolated from the experience of healthcare professionals. It is important to recognize the limitations of the evidence that supports many of these guidelines so that research can be undertaken and future guidelines can be based on a larger body of scientific evidence.

Definition of First Aid

We define first aid as the assessments and interventions that can be performed by a bystander (or by the victim) with minimal or no medical equipment. A first aid provider is defined as someone with formal training in first aid, emergency care, or medicine who provides first aid. First aid assessments and interventions should be medically

sound and based on scientific evidence or, in the absence of such evidence, on expert consensus. Administration of first aid must not delay activation of the emergency medical services (EMS) system or other medical assistance when required. We strongly believe that education in first aid should be universal: everyone can learn first aid and everyone should.

The scope of first aid is not purely scientific; it is influenced by both training and regulatory issues. The definition of scope is therefore variable, and should be defined according to circumstances, need, and regulatory requirements.

Calling for Help

A first aid provider must be able to recognize when help is needed and how to get it. First aid providers should learn how and when to access the EMS system, how to activate the on-site emergency response plan (ERP), and how to contact the Poison Control Center (see “Poison Emergencies” below).

Positioning the Victim

As a general rule a victim should not be moved, especially if you suspect, from the victim's position or the nature of the injury, that the victim may have a spinal injury (see “Spine Stabilization” below). There are times, however, when the victim should be moved:

- If the area is unsafe for the rescuer or the victim, move the victim to a safe location if it is safe to do so.
- If the victim is face down and is unresponsive, turn the victim face up.
- If the victim has difficulty breathing because of copious secretions or vomiting, or if you are alone and have to leave an unresponsive victim to get help, place the victim in a modified **High Arm IN Endangered Spine (HAINES)** recovery position:^{9,10} Extend one of the victim's arms above the head and roll the body to the side so the victim's head rests on the extended arm. Bend both legs to stabilize the victim (Class IIb, LOE C).
- If a victim shows evidence of shock, have the victim lie supine. If there is no evidence of trauma or injury, raise the feet about 6 to 12 inches (about 30° to 45°) (Class IIb, LOE C). Do not raise the feet if the movement or the position causes the victim any pain.

The evidence for a benefit to raising the feet is extrapolated from leg raising studies on volume expansion; there are no studies on the effect of leg raising as a first aid maneuver for shock. The results of the volume expansion studies are contradictory with some showing an increase in cardiac output,^{11–13} while others show no change in cardiac output or mean arterial pressure^{14–18} with leg raising.

Oxygen

There is insufficient evidence to recommend routine use of supplementary oxygen by a first aid provider for victims complaining of chest discomfort^{19,20} or shortness of breath²¹

(Class IIb, LOE C). Supplementary oxygen administration may be beneficial as part of first aid for divers with a decompression injury (Class IIb, LOE C²²).

Medical Emergencies

Breathing Difficulties

The incidence of acute asthma is increasing, especially in urban populations.²³ Many victims with asthma take a prescribed bronchodilator medication and can self-administer it.^{24–26} First aid providers are not expected to make a diagnosis of asthma, but they may assist the victim in using the victim's prescribed bronchodilator medication (Class IIa, LOE B) under the following conditions:

- The victim states that he or she is having an asthma attack or symptoms associated with a previously diagnosed breathing disorder, and the victim has the prescribed medications or inhaler in his or her possession.
- The victim identifies the medication and is unable to administer it without assistance.²⁴

First aid providers should become familiar with inhalers so that they can assist a victim with an acute asthma attack in using the inhaler.

Anaphylaxis

Allergies are relatively common, but only a small proportion of people with allergies develop anaphylactic reactions. An anaphylactic reaction is a progressive series of signs and symptoms characterized by swelling, breathing difficulty, an itching rash, and eventually shock, which, if left untreated, may lead to death. Some of these signs and symptoms can also be present in other conditions, and first aid rescuers should not be expected to make a diagnosis of anaphylaxis.^{27–30}

Older patients who suffer from anaphylactic reactions know their signs and symptoms and many carry a lifesaving epinephrine auto-injector. With proper training, parents can be taught to correctly use an auto-injector to administer epinephrine to their allergic children.³¹ All too often, however, neither the victim nor family members know how to correctly use an auto-injector.^{32–34} First aid providers should be familiar with the epinephrine auto-injector so that they can help a victim with an anaphylactic reaction to self-administer it. First aid providers should also know how to administer the auto-injector if the victim is unable to do so, provided that the medication has been prescribed by a physician and state law permits it (Class IIb, LOE B).

In retrospective studies^{35–37} 18% to 35% of patients having signs of anaphylaxis required a second dose of epinephrine if symptoms persisted or progressed after the first dose. Because of the difficulty in making a diagnosis of anaphylaxis^{27–30,38,39} and the potential harm from epinephrine if the diagnosis is incorrect,^{40–43} first aid providers are advised to seek medical assistance if symptoms persist, rather than routinely administering a second dose of epinephrine. In unusual circumstances, when advanced medical assistance is not available, a second dose of

epinephrine may be given if symptoms of anaphylaxis persist (Class IIb, LOE C).

Seizures

The general principles of first aid management of seizures are to

- Ensure an open airway.
- Prevent injury.

Do not restrain the victim during a seizure. Do not try to open the victim's mouth or try to place any object between the victim's teeth or in the mouth. Restraining the victim may cause musculoskeletal or soft-tissue injury. Placing an object in the victim's mouth may cause dental damage or aspiration (Class IIa, LOE C). It is not unusual for the victim to be unresponsive or confused for a short time after a seizure.

Chest Discomfort

Because it is very difficult, even for the healthcare professional, to differentiate chest discomfort of cardiac origin from other chest discomfort, the first aid provider should assume that chest discomfort is cardiac until proven otherwise. Cardiac chest discomfort is often described as "crushing" or "pressing" and is often accompanied by shortness of breath or perspiration. But cardiac chest discomfort may not have these classical characteristics, especially in women. Call EMS immediately for anyone with chest discomfort. Do not delay and do not try to transport the patient to a healthcare facility yourself.

While waiting for EMS to arrive, the first aid provider may encourage the victim to chew 1 adult (not enteric coated) or 2 low-dose "baby" aspirin if the patient has no allergy to aspirin or other contraindication to aspirin, such as evidence of a stroke or recent bleeding (Class IIa, LOE A).^{44–46}

Injury Emergencies

Bleeding

Control of bleeding is a basic skill of first aid and one of the few actions with which a first aid provider can critically influence outcome.

Direct Pressure

Bleeding is best controlled by applying pressure until bleeding stops^{47–53} or EMS rescuers arrive (Class I, LOE A). The amount of pressure applied and the time the pressure is held are the most important factors affecting successful control of bleeding. The pressure must be firm, and it must be maintained for a long time. Methods of applying pressure include

- Manual pressure on gauze or other cloth placed over the bleeding source. If bleeding continues, do not remove the gauze; add more gauze on top and apply more pressure.
- If it is not possible to provide continuous manual pressure, wrap an elastic bandage firmly over gauze to hold it in place with pressure.^{54–57}

Tourniquets

Although tourniquets have been shown to control bleeding effectively on the battlefield^{58–60} and during surgery and have been used by paramedics in a civilian setting without complications,⁶¹ there are no studies on controlling bleeding with first aid provider use of a tourniquet. Potential dangers of prolonged tourniquet application include temporary⁶² or permanent⁶³ injury to the underlying nerves and muscles,⁶⁴ and systemic complications resulting from limb ischemia,⁶⁵ including acidemia, hyperkalemia, arrhythmias, shock, and death. Complications are related to tourniquet pressure⁶⁶ and duration of occlusion,⁶⁷ but there is insufficient evidence to determine a minimal critical time beyond which irreversible complications may occur. Because of the potential adverse effects of tourniquets and difficulty in their proper application, use of a tourniquet to control bleeding of the extremities is indicated only if direct pressure is not effective or possible (Class IIb, LOE B). Specifically designed tourniquets appear to be better than ones that are improvised,^{60,68–71} but tourniquets should only be used with proper training (Class IIa, LOE B). If a tourniquet is used, make sure that you note the time it was applied and communicate that time to EMS personnel.

Pressure Points and Elevation

Elevation and use of pressure points are not recommended to control bleeding (Class III, LOE C). This new recommendation is made because there is evidence that other ways of controlling bleeding are more effective. The hemostatic effect of elevation has not been studied. No effect on distal pulses was found in volunteers when pressure points were used.⁷² Most important, these unproven procedures may compromise the proven intervention of direct pressure, so they could be harmful.

Hemostatic Agents

Among the large number of commercially available hemostatic agents, some have been shown to be effective.^{73–76} However, their routine use in first aid cannot be recommended at this time because of significant variation in effectiveness by different agents and their potential for adverse effects, including tissue destruction with induction of a proembolic state and potential thermal injury (Class IIb, LOE B).

Wounds and Abrasions

Superficial wounds and abrasions should be thoroughly irrigated with a large volume of warm or room temperature potable water with or without soap^{77–82} until there is no foreign matter in the wound (Class I, LOE A). Cold water appears to be as effective as warm water, but it is not as comfortable. If running water is unavailable, use any source of clean water. Wounds heal better with less infection if they are covered with an antibiotic ointment or cream and a clean occlusive dressing (Class IIa, LOE A).^{83–85} Apply antibiotic ointment or cream only if the wound is an abrasion or a superficial injury and only if the victim has no known allergies to the antibiotic.

Burns

Thermal Burns

Cool thermal burns with cold (15° to 25°C) tap water as soon as possible and continue cooling at least until pain is relieved (Class I, LOE B).^{86–93} Cooling reduces pain, edema, and depth of injury. It speeds healing and may reduce the need for excision and grafting of deep burns. Don't apply ice directly to a burn; it can produce tissue ischemia (Class III, LOE B). Prolonged cold exposure to small burns, and even brief exposure if the burn is large, can cause further local tissue injury^{93–95} and hypothermia.

Burn Blisters

Loosely cover burn blisters with a sterile dressing but leave blisters intact because this improves healing and reduces pain (Class IIa, LOE B).^{96–99}

Electric Injuries

The severity of electric injuries can vary widely, from an unpleasant tingling sensation caused by low-intensity current to thermal burns, cardiopulmonary arrest, and death. Thermal burns may result from burning clothing that is in contact with the skin or from electric current traversing a portion of the body. When current traverses the body, thermal burns may be present at the entry and exit points and along its internal pathway. Cardiopulmonary arrest is the primary cause of immediate death from electrocution.¹⁰⁰ Cardiac arrhythmias, including ventricular fibrillation, ventricular asystole, and ventricular tachycardia that progresses to ventricular fibrillation, may result from exposure to low- or high-voltage current.¹⁰¹ Respiratory arrest may result from electric injury to the respiratory center in the brain or from tetanic contractions or paralysis of respiratory muscles.

Do not place yourself in danger by touching an electrocuted victim while the power is on (Class III, LOE C). Turn off the power at its source; at home the switch is usually near the fuse box. In case of high-voltage electrocutions caused by fallen power lines, immediately notify the appropriate authorities (eg, 911 or fire department). All materials conduct electricity if the voltage is high enough, so do not enter the area around the victim or try to remove wires or other materials with any object, including a wooden one, until the power has been turned off by knowledgeable personnel.

Once the power is off, assess the victim, who may need CPR, defibrillation, and treatment for shock and thermal burns. All victims of electric shock require medical assessment because the extent of injury may not be apparent.

Spine Stabilization

There is approximately a 2% risk of injury to the cervical spine after blunt trauma that is serious enough to require spinal imaging in an emergency department,^{102,103} and this risk is tripled in patients with craniofacial injury.¹⁰⁴ Most victims with spinal injuries are males between the ages of 10 and 30 years. Motor vehicles cause approximately half

of all spinal injuries; many of the remainder are caused by falls (especially from a height or diving), sports, and assaults.¹⁰⁵

If the cervical spine is injured, the spinal cord may be unprotected, and further injury (secondary spinal cord injury) could result from stresses to the cord that occur when the victim is manipulated or moved. This could result in permanent neurological damage including quadriplegia.^{106,107} Only one controlled but underpowered study with some methodological problems¹⁰⁸ has examined this question. In the study, the group of injured victims with spinal immobilization by emergency medical technicians using equipment failed to show any neurological benefit compared with a group of injured victims without spinal immobilization.

Because of the dire consequences if secondary injury does occur, maintain spinal motion restriction by manually stabilizing the head so that the motion of head, neck, and spine is minimized (Class IIb, LOE C). First aid providers should not use immobilization devices because their benefit in first aid has not been proven and they may be harmful (Class III, LOE C). Immobilization devices may be needed in special circumstances when immediate extrication (eg, rescue of drowning victim) is required, but first aid providers should not use these devices unless they have been properly trained in their use.

First aid rescuers cannot conclusively identify a victim with a spinal injury, but they should suspect spinal injury if an injured victim has any of the following risk factors (these have been modified slightly from the 2005 *American Heart Association and American Red Cross First Aid Guidelines*^{103,109–114}):

- Age ≥ 65 years
- Driver, passenger, or pedestrian, in a motor vehicle, motorized cycle, or bicycle crash
- Fall from a greater than standing height
- Tingling in the extremities
- Pain or tenderness in the neck or back
- Sensory deficit or muscle weakness involving the torso or upper extremities
- Not fully alert or is intoxicated
- Other painful injuries, especially of the head and neck
- Children 2 years of age or older with evidence of head or neck trauma

Musculoskeletal Trauma

Sprains and Strains

Soft-tissue injuries include joint sprains and muscle contusions. Cold application decreases hemorrhage, edema, pain, and disability,^{115–120} and it is reasonable to apply cold to a soft-tissue injury. Cooling is best accomplished with a plastic bag or damp cloth filled with a mixture of ice and water; the mixture is better than ice alone.^{121–123} Refreezable gel packs do not cool as effectively as an ice-water mixture.^{124,125} To prevent cold injury, limit each application of cold to periods ≤ 20 minutes.^{126–128} If that length of time is uncomfortable, limit application to 10 minutes.¹²⁹ Place a barrier, such as a

thin towel, between the cold container and the skin (Class IIb, LOE C^{126,128}).

It is not clear whether a compression bandage is helpful for a joint injury. Heat application to a contusion or injured joint is not as good a first aid measure as cold application.¹¹⁵

Fractures

Assume that any injury to an extremity includes a bone fracture. Cover open wounds with a dressing. Do not move or try to straighten an injured extremity (Class III, LOE C). There is no evidence that straightening an angulated suspected long bone fracture shortens healing time or reduces pain prior to permanent fixation. Expert opinion suggests that splinting may reduce pain¹³⁰ and prevent further injury. So, if you are far from definitive health care, stabilize the extremity with a splint in the position found (Class IIa, LOE C). If a splint is used, it should be padded to cushion the injury. If an injured extremity is blue or extremely pale, activate EMS immediately because this could be a medical emergency. A victim with an injured lower extremity should not bear weight until advised to do so by a medical professional.

Human and Animal Bites

Irrigate human and animal bites with copious amounts of water (Class I, LOE B). This irrigation has been shown to prevent rabies from animal bites^{131,132} and bacterial infection.¹³³

Snakebites

Do not apply suction as first aid for snakebites (Class III, LOE C). Suction does remove some venom, but the amount is very small.¹³⁴ Suction has no clinical benefit¹³⁵ and it may aggravate the injury.^{136–138}

Applying a pressure immobilization bandage with a pressure between 40 and 70 mm Hg in the upper extremity and between 55 and 70 mm Hg in the lower extremity around the entire length of the bitten extremity is an effective and safe way to slow the dissemination of venom by slowing lymph flow (Class IIa, LOE C^{139,140}). For practical purposes pressure is sufficient if the bandage is comfortably tight and snug but allows a finger to be slipped under it. Initially it was theorized that slowing lymphatic flow by external pressure would only benefit victims bitten by snakes producing neurotoxic venom, but the effectiveness of pressure immobilization has also been demonstrated for bites by non-neurotoxic American snakes.^{140,141} The challenge is to find a way to teach the application of the correct snugness of the bandage because inadequate pressure is ineffective and too much pressure may cause local tissue damage. It has also been demonstrated that, once learned, retention of the skill of proper pressure and immobilization application is poor.^{142,143}

Jellyfish Stings

This section is new to the First Aid Guidelines. First aid for jellyfish stings consists of two important actions: preventing further nematocyst discharge and pain relief. To inactivate venom load and prevent further envenomation, jellyfish stings should be liberally washed with

vinegar (4% to 6% acetic acid solution) as soon as possible for at least 30 seconds (Class IIa, LOE B). The inactivation of venom has been demonstrated for *Olindias sambaquiensis*¹⁴⁴ and for *Physalia physalis* (Portuguese man-of-war).¹⁴⁵ If vinegar is not available, a baking soda slurry may be used instead.¹⁴⁵

For the treatment of pain, after the nematocysts are removed or deactivated, jellyfish stings should be treated with hot-water immersion when possible (Class IIa, LOE B). The victim should be instructed to take a hot shower or immerse the affected part in hot water (temperature as hot as tolerated, or 45°C if there is the capability to regulate temperature), as soon as possible, for at least 20 minutes or for as long as pain persists.^{146–149} If hot water is not available, dry hot packs or, as a second choice, dry cold packs may be helpful in decreasing pain but these are not as effective as hot water (Class IIb, LOE B^{146,150,151}). Topical application of aluminum sulfate or meat tenderizer, commercially available aerosol products, fresh water wash, and papain, an enzyme derived from papaya used as a local medicine, are even less effective in relieving pain (Class IIb, LOE B^{147,152}).

Pressure immobilization bandages are not recommended for the treatment of jellyfish stings because animal studies^{153,154} show that pressure with an immobilization bandage causes further release of venom, even from already fired nematocysts (Class III, LOE C).

Dental Injuries

Traumatic dental injuries are common. The first aid for an avulsed tooth is as follows:

- Clean bleeding wound(s) with saline solution or tap water.
- Stop bleeding by applying pressure with gauze or cotton.
- Handle the tooth by the crown, not the root (ie, do not handle the part that was beneath the gum).
- Place the tooth in milk, or clean water if milk is not available.
- Contact the patient's dentist or take the tooth and victim to an emergency care center as quickly as possible (Class IIa, LOE C).^{155–158}

Environmental Emergencies

Cold Emergencies

Hypothermia

Hypothermia is caused by exposure to cold. The urgency of treatment depends on the length of exposure and the victim's body temperature. Begin rewarming a victim of hypothermia immediately by moving the victim to a warm environment, removing wet clothing, and wrapping all exposed body surfaces with anything at hand, such as blankets, clothing, and newspapers. If the hypothermia victim is far from definitive health care, begin active rewarming (Class IIa, LOE B^{159,160}) although the effectiveness of active rewarming has not been evaluated. Active rewarming should not delay definitive care. Potential methods of active rewarming include placing the victim near a heat source and placing

containers of warm, but not hot, water in contact with the skin.

Frostbite

Frostbite usually affects an exposed part of the body such as the extremities and nose. In case of frostbite, remove wet clothing and dry and cover the victim to prevent hypothermia. Transport the victim to an advanced medical facility as rapidly as possible. Do not try to rewarm the frostbite if there is any chance that it might refreeze^{161,162} or if you are close to a medical facility (Class III, LOE C).

Minor or superficial frostbite (frostnip) can be treated with simple, rapid rewarming using skin-to-skin contact such as a warm hand.

Severe or deep frostbite should be rewarmed within 24 hours of injury and this is best accomplished by immersing the frostbitten part in warm (37° to 40°C or approximately body temperature) water for 20 to 30 minutes (Class IIb, LOE C^{161–170}). Chemical warmers should not be placed directly on frostbitten tissue because they can reach temperatures that can cause burns (Class III, LOE C¹⁷¹). Following rewarming, efforts should be made to protect frostbitten parts from refreezing and to quickly evacuate the patient for further care. The effectiveness of ibuprofen or other nonsteroidal antiinflammatory drugs (NSAIDs) in frostbite has not been well established in human studies.^{170,172–175}

Heat Emergencies

Heat-induced symptoms, often precipitated by vigorous exercise, may include heat cramps, heat exhaustion, and heat stroke.

Heat cramps are painful involuntary muscle spasms that most often affect the calves, arms, abdominal muscles, and back. First aid includes rest, cooling off, and drinking an electrolyte-carbohydrate mixture, such as juice, milk, or a commercial electrolyte-carbohydrate drink.^{176–185} Stretching, icing, and massaging the painful muscles may be helpful. Exercise should not be resumed until all symptoms have resolved.

Heat exhaustion is caused by a combination of exercise-induced heat and fluid and electrolyte loss as sweat. Signs and symptoms may start suddenly and include: nausea, dizziness, muscle cramps, feeling faint, headache, fatigue, and heavy sweating. Heat exhaustion is a serious condition because it can rapidly advance to the next stage, heat stroke, which can be fatal. Heat exhaustion must be vigorously treated by having the victim lie down in a cool place, taking off as many clothes as possible, cooling the victim with a cool water spray, and encouraging the victim to drink cool fluids, preferably containing carbohydrates and electrolytes.

Heat stroke includes all the symptoms of heat exhaustion plus signs of central nervous system involvement, including dizziness, syncope, confusion, or seizures. The most important action by a first aid provider for a victim of heat stroke is to begin immediate cooling, preferably by immersing the victim up to the chin in cold water.^{186–189} It is also important to activate the EMS system. Heat stroke requires emergency

treatment with intravenous fluids. Do not try to force the victim to drink liquids.

Drowning

Drowning is a major cause of unintentional death. Methods of preventing drowning include isolation fencing around swimming pools (gates should be self-closing and self-latching),¹⁹⁰ wearing personal flotation devices (life jackets) while in, around, or on water, never swimming alone, and avoiding swimming or operating motorized watercraft while intoxicated. Outcome following drowning depends on the duration of the submersion, the water temperature, and how promptly CPR is started.^{191,192} Occasional case reports have documented intact neurological survival in children following prolonged submersion in icy waters.^{193,194}

Remove the victim rapidly and safely from the water, but do not place yourself in danger. If you have special training, you can start rescue breathing while the victim is still in the water¹⁹⁵ providing that it does not delay removing the victim from the water. There is no evidence that water acts as an obstructive foreign body, so do not waste time trying to remove it with abdominal or chest thrusts. Start CPR and, if you are alone, continue with about 5 cycles (about 2 minutes) of chest compressions and ventilations before activating EMS. If 2 rescuers are present, send 1 rescuer to activate EMS immediately.

Poison Emergencies

If the patient exhibits any signs or symptoms of a life-threatening condition, (eg, sleepiness, seizures, difficulty breathing, vomiting) after exposure to a poison, activate the EMS immediately.

Poison Control Centers

There are many poisonous substances in the home and worksite. It is important to understand the toxic nature of the chemical substances in the environment and the proper protective equipment and emergency procedures in case of toxic exposure. The Poison Help hotline of the American Association of Poison Control Centers (800-222-1222) is an excellent resource in the United States for information about treating ingestion of, or exposure to, a potential poison. Further information is available at www.aapcc.org. Similar resources may be available internationally, and their contact information (eg, 112 in Europe) should be standard in international first aid training. When phoning a poison control center or other emergency medical services, know the nature and time of exposure and the name of the product or toxic substance.

Chemical Burns

Brush powdered chemicals off the skin with a gloved hand or piece of cloth. Remove all contaminated clothing from the victim, making sure you do not contaminate yourself in the process. In case of exposure to an acid or alkali on the skin^{196–202} or eye,^{203–208} immediately irrigate the affected area with copious amounts of water (Class I, LOE B).

Toxic Eye Injury

Rinse eyes exposed to toxic substances immediately with a copious amount of water (Class I, LOE C^{203,209,210}), unless a specific antidote is available.^{203,210,211}

Ingested Poisons

Treatment With Milk or Water

Do not administer anything by mouth for any poison ingestion unless advised to do so by a poison control center or emergency medical personnel because it may be harmful (Class III, LOE C). There is insufficient evidence that dilution of the ingested poison with water or milk is of any benefit as a first aid measure. Animal studies^{212–216} have shown that dilution or neutralization of a caustic agent with water or milk reduces tissue injury, but no human studies have shown a clinical benefit. Possible adverse effects of water or milk administration include emesis and aspiration.

Activated Charcoal

Do not administer activated charcoal to a victim who has ingested a poisonous substance unless you are advised to do so by poison control center or emergency medical personnel (Class IIb, LOE C). There is no evidence that activated charcoal is effective as a component of first aid. It may be safe to administer,^{217,218} but it has not been shown to be beneficial, and there are reports of it causing harm.^{219–221} In addition the majority of children will not take the recommended dose.²²²

Ipecac

Do not administer syrup of ipecac for ingestions of toxins (Class III, LOE B). Several studies^{223–225} found that there is no clinically relevant advantage to administering syrup of ipecac; its administration is not associated with decreased healthcare utilization.²²⁶ Untoward effects of ipecac administration include intractable emesis and delayed care in an advanced medical facility.^{227,228}

Disclosures

Guidelines Part 17: First Aid: Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board	Other
David Markenson	NYMC—Interim Chair; EMA—Chief Pediatric ED	None	None	None	None	None	None
Jeffrey D. Ferguson	Brody School of Medicine, East Carolina University—Assistant Professor	None	None	None	None	None	*Serving as an expert witness in two ongoing lawsuits involving EMS related cases. Billing for this service has not yet occurred and will likely represent less than \$10,000 per 12 months. This payment is expected to come directly to me
Leon Chameides	Emeritus Director Pediatric Cardiology, Connecticut Children's Medical Center, Clinical Professor, University of Connecticut	None	None	None	None	None	None
Pascal Cassan	French Red Cross, National Medical Advisor and Coordinator of the European Reference Centre for first aid education Coordinator of the Scientific Commission of First Aid for the French Interior Ministry (unpaid)	None	None	None	None		None
Kin-Lai Chung	Hong Kong Hospital Authority Hospital Chief Executive	None	None	None	None	None	None
Jonathan Epstein	NorthEast Emergency Medical Services, Inc.—Regional EMS Council: Provide EMS System Oversight. Also provide education (First aid and CPR/AED) as an AHA Training Center. Executive Director; Isis Maternity: Pre-Natal and Post Partum edu.- Provide CPR and First Aid Training via AHA Curriculum. For-Profit Company—Instructor	None	None	None	None	*Volunteer: American Red Cross Advisory Council on First Aid, Aquatics, Safety and Preparedness (ACFASP) Vice-Chair	None
Louis Gonzales	City of Austin - Office of the Medical Director: EMS System Medical Director Staff—Performance Management & Research Coordinator *Beginning July 1, 2009, I will serve as a paid consultant to the AHA ECC Product Development Group as a Senior Science Editor. This assignment will include providing Science review of AHA First Aid Products	None	None	None	None	None	None
Rita Ann Herrington	Minute Clinic—Family Nurse Practitioner	None	None	None	None	None	None
Jeffrey Pellegrino	Kent State University—Assistant Dir Faculty Professional Dev. Center	None	None	None	None	†Wilderness First Aid consultant for StayWell publishing	None
Norda Ratcliff	Bloomington Hospital Prompt Care—Nurse Practitioner	None	None	None	None	None	None
Adam Singer	Stony Brook University—Physician	None	None	None	None	None	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be “significant” if (a) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be “modest” if it is less than “significant” under the preceding definition.

*Modest.

†Significant.

References

- 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care part 14: first aid. *Circulation*. 2005;112(suppl):IV-196–IV-203.
- Markenson D, Ferguson JD, Chameides L, Cassan P, Chung KL, Epstein JL, Gonzales L, Hazinski MF, Herrington RA, Pelligrino JL, Ratcliff N, Singer AJ; on behalf of the First Aid Chapter Collaborators. Part 13: first aid: 2010 American Heart Association and American Red Cross International Consensus on First Aid Science With Treatment Recommendations. *Circulation*. 2010;122(suppl 2):S582–S605.
- Lewis TH. *The Medicine Men: Oglala Sioux Ceremony and Healing*. Lincoln, Neb: University of Nebraska Press; 1992.
- Pearn J. The earliest days of first aid. *BMJ*. 1994;309:1718–1720.
- The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care, part 5: new guidelines for first aid. *Circulation*. 2000;102(suppl):I-77–I-85.
- Neely KW, Drake ME, Moorhead JC, Schmidt TA, Skeen DT, Wilson EA. Multiple options and unique pathways: a new direction for EMS? *Ann Emerg Med*. 1997;30:797–799.
- Callahan M. Quantifying the scanty science of prehospital emergency care. *Ann Emerg Med*. 1997;30:785–790.
- Spaite DW, Criss EA, Valenzuela TD, Meislin HW. Developing a foundation for the evaluation of expanded-scope EMS: a window of opportunity that cannot be ignored. *Ann Emerg Med*. 1997;30:791–796.
- Blake WE, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position: an experimental comparison between the lateral recovery position and the modified HAINES position. *Resuscitation*. 2002;53:289–297.
- Gunn BD, Eizenberg N, Silberstein M, McMeeken JM, Tully EA, Stillman BC, Brown DJ, Gutteridge GA. How should an unconscious person with a suspected neck injury be positioned? *Prehosp Disaster Med*. 1995;10:239–244.
- Wong DH, O'Connor D, Tremper KK, Zaccari J, Thompson P, Hill D. Changes in cardiac output after acute blood loss and position change in man. *Crit Care Med*. 1989;17:979–983.
- Boulain T, Achard JM, Teboul JL, Richard C, Perrotin D, Ginies G. Changes in BP induced by passive leg raising predict response to fluid loading in critically ill patients. *Chest*. 2002;121:1245–1252.
- Teboul JL, Monnet X. Prediction of volume responsiveness in critically ill patients with spontaneous breathing activity. *Curr Opin Crit Care*. 2008;14:334–339.
- Gaffney FA, Bastian BC, Thal ER, Atkins JM, Blomqvist CG. Passive leg raising does not produce a significant or sustained autotransfusion effect. *J Trauma*. 1982;22:190–193.
- Ostrow CL. Use of the Trendelenburg position by critical care nurses: Trendelenburg survey. *Am J Crit Care*. 1997;6:172–176.
- Shammas A, Clark AP. Trendelenburg positioning to treat acute hypotension: helpful or harmful? *Clin Nurse Spec*. 2007;21:181–187.
- Reich DL, Konstadt SN, Raissi S, Hubbard M, Thys DM. Trendelenburg position and passive leg raising do not significantly improve cardiopulmonary performance in the anesthetized patient with coronary artery disease. *Crit Care Med*. 1989;17:313–317.
- Johnson BA. Stark II, phase II: positive changes and lingering uncertainties. *MGMA Connex*. 2004;4:48–51, 1.
- Rawles JM, Kenmore AC. Controlled trial of oxygen in uncomplicated myocardial infarction. *BMJ*. 1976;1:1121–1123.
- Nicholson C. A systematic review of the effectiveness of oxygen in reducing acute myocardial ischaemia. *J Clin Nurs*. 2004;13:996–1007.
- Austin M, Wood-Baker R. Oxygen therapy in the pre-hospital setting for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev*. 2006;3:CD005534.
- Longphre JM, Denoble PJ, Moon RE, Vann RD, Freiburger JJ. First aid normobaric oxygen for the treatment of recreational diving injuries. *Undersea Hyperb Med*. 2007;34:43–49.
- Mannino DM, Homa DM, Pertowski CA, Ashizawa A, Nixon LL, Johnson CA, Ball LB, Jack E, Kang DS. Surveillance for asthma: United States, 1960–1995. *MMWR CDC Surveill Summ*. 1998;47:1–27.
- Hamid S, Kumaradevan J, Cochrane GM. Single centre open study to compare patient recording of PRN salbutamol use on a daily diary card with actual use as recorded by the MDI compliance monitor. *Respir Med*. 1998;92:1188–1190.
- O'Driscoll BR, Kay EA, Taylor RJ, Weatherby H, Chetty MC, Bernstein A. A long-term prospective assessment of home nebulizer treatment. *Respir Med*. 1992;86:317–325.
- Simon HK. Caregiver knowledge and delivery of a commonly prescribed medication (albuterol) for children. *Arch Pediatr Adolesc Med*. 1999;153:615–618.
- Kim JS, Sinacore JM, Pongracic JA. Parental use of EpiPen for children with food allergies. *J Allergy Clin Immunol*. 2005;116:164–168.
- Sicherer SH, Simons FE. Quandaries in prescribing an emergency action plan and self-injectable epinephrine for first-aid management of anaphylaxis in the community. *J Allergy Clin Immunol*. 2005;115:575–583.
- Pouessel G, Deschildre A, Castelain C, Sardet A, Sagot-Bevenot S, de Sauve-Boeuf A, Thumerelle C, Santos C. Parental knowledge and use of epinephrine auto-injector for children with food allergy. *Pediatr Allergy Immunol*. 2006;17:221–226.
- Rainbow J, Browne GJ. Fatal asthma or anaphylaxis? *Emerg Med J*. 2002;19:415–417.
- Dobbie A, Robertson CM. Provision of self-injectable adrenaline for children at risk of anaphylaxis: its source, frequency and appropriateness of use, and effect. *Ambul Child Health*. 1998;4:283–288.
- Clegg SK, Ritchie JM. "EpiPen" training: a survey of the provision for parents and teachers in West Lothian. *Ambul Child Health*. 2001;7:169–175.
- Gold MS, Sainsbury R. First aid anaphylaxis management in children who were prescribed an epinephrine autoinjector device (EpiPen). *J Allergy Clin Immunol*. 2000;106(part 1):171–176.
- Sicherer SH, Forman JA, Noone SA. Use assessment of self-administered epinephrine among food-allergic children and pediatricians. *Pediatrics*. 2000;105:359–362.
- Korenblat P, Lundie MJ, Dankner RE, Day JH. A retrospective study of epinephrine administration for anaphylaxis: how many doses are needed? *Allergy Asthma Proc*. 1999;20:383–386.
- Uguz A, Lack G, Pumphrey R, Ewan P, Warner J, Dick J, Briggs D, Clarke S, Reading D, Hourihane J. Allergic reactions in the community: a questionnaire survey of members of the anaphylaxis campaign. *Clin Exp Allergy*. 2005;35:746–750.
- Rudders SA, Banerji A, Corel B, Clark S, Camargo CA Jr. Multicenter study of repeat epinephrine treatments for food-related anaphylaxis. *Pediatrics*. 2010;125:e711–e718.
- Sicherer SH, Simons FE. Self-injectable epinephrine for first-aid management of anaphylaxis. *Pediatrics*. 2007;119:638–646.
- Gaca AM, Frush DP, Hohenhaus SM, Luo X, Ancarana A, Pickles A, Frush KS. Enhancing pediatric safety: using simulation to assess radiology resident preparedness for anaphylaxis from intravenous contrast media. *Radiology*. 2007;245:236–244.
- Pumphrey RS. Lessons for management of anaphylaxis from a study of fatal reactions. *Clin Exp Allergy*. 2000;30:1144–1150.
- Horowitz BZ, Jadallah S, Derlet RW. Fatal intracranial bleeding associated with prehospital use of epinephrine. *Ann Emerg Med*. 1996;28:725–727.
- Davis CO, Wax PM. Prehospital epinephrine overdose in a child resulting in ventricular dysrhythmias and myocardial ischemia. *Pediatr Emerg Care*. 1999;15:116–118.
- Anchor J, Settipane RA. Appropriate use of epinephrine in anaphylaxis. *Am J Emerg Med*. 2004;22:488–490.
- Zijlstra F, Ernst N, De Boer M-J, Nibbering E, Suryapranata H, Hoorntje JCA, Dambrink J-HE, Van't Hof AWJ, Verheugt FWA. Influence of prehospital administration of aspirin and heparin on initial patency of the infarct-related artery in patients with acute ST elevation myocardial infarction. *J Am Coll Cardiol*. 2002;39:1733–1737.
- ISIS-2 (Second International Study of Infarct Survival) Collaborative Group. Randomised trial of intravenous streptokinase, oral aspirin, both, or neither among 17,187 cases of suspected acute myocardial infarction: ISIS-2. *Lancet*. 1988;2:349–360.
- Barbash IM, Freemark D, Gottlieb S, Hod H, Hasin Y, Battler A, Crystal E, Matetzky S, Boyko V, Mandelzweig L, Behar S, Leor J. Outcome of myocardial infarction in patients treated with aspirin is enhanced by pre-hospital administration. *Cardiology*. 2002;98:141–147.
- Lehmann KG, Heath-Lange SJ, Ferris ST. Randomized comparison of hemostasis techniques after invasive cardiovascular procedures. *Am Heart J*. 1999;138(part 1):1118–1125.
- Koreny M, Riedmuller E, Nikfardjam M, Siostrzonek P, Mullner M. Arterial puncture closing devices compared with standard manual compression after cardiac catheterization: systematic review and meta-analysis. *JAMA*. 2004;291:350–357.
- Mlekusch W, Dick P, Haumer M, Sabeti S, Minar E, Schillinger M. Arterial puncture site management after percutaneous transluminal procedures using a hemostatic wound dressing (Clo-Sur P.A.D.) versus

- conventional manual compression: a randomized controlled trial. *J Endovasc Ther.* 2006;13:23–31.
50. Upponi SS, Ganeshan AG, Warakaulle DR, Phillips-Hughes J, Boardman P, Uberoi R. Angioseal versus manual compression for haemostasis following peripheral vascular diagnostic and interventional procedures: a randomized controlled trial. *Eur J Radiol.* 2007;61:332–334.
 51. Simon A, Bumgarner B, Clark K, Israel S. Manual versus mechanical compression for femoral artery hemostasis after cardiac catheterization. *Am J Crit Care.* 1998;7:308–313.
 52. Walker SB, Cleary S, Higgins M. Comparison of the FemoStop device and manual pressure in reducing groin puncture site complications following coronary angioplasty and coronary stent placement. *Int J Nurs Pract.* 2001;7:366–375.
 53. Yadav JS, Ziada KM, Almany S, Davis TP, Castaneda F. Comparison of the QuickSeal Femoral Arterial Closure System with manual compression following diagnostic and interventional catheterization procedures. *Am J Cardiol.* 2003;91:1463–1466, A1466.
 54. Naimer SA, Chemla F. Elastic adhesive dressing treatment of bleeding wounds in trauma victims. *Am J Emerg Med.* 2000;18:816–819.
 55. Pillgram-Larsen J, Mellesmo S. Not a tourniquet, but compressive dressing: experience from 68 traumatic amputations after injuries from mines [in Norwegian]. *Tidsskr Nor Lægeforen.* 1992;112:2188–2190.
 56. Naimer SA, Nash M, Niv A, Lapid O. Control of massive bleeding from facial gunshot wound with a compact elastic adhesive compression dressing. *Am J Emerg Med.* 2004;22:586–588.
 57. Naimer SA, Anat N, Katif G. Evaluation of techniques for treating the bleeding wound. *Injury.* 2004;35:974–979.
 58. Lakstein D, Blumenfeld A, Sokolov T, Lin G, Bssorai R, Lynn M, Ben-Abraham R. Tourniquets for hemorrhage control on the battlefield: a 4-year accumulated experience. *J Trauma.* 2003;54(suppl):S221–S225.
 59. Beekley AC, Sebesta JA, Blackburne LH, Herbert GS, Kauvar DS, Baer DG, Walters TJ, Mullenix PS, Holcomb JB. Prehospital tourniquet use in Operation Iraqi Freedom: effect on hemorrhage control and outcomes. *J Trauma.* 2008;64(suppl):S28–S37.
 60. Kragh JF Jr, Walters TJ, Baer DG, Fox CJ, Wade CE, Salinas J, Holcomb JB. Practical use of emergency tourniquets to stop bleeding in major limb trauma. *J Trauma.* 2008;64(suppl):S38–S49.
 61. Kalish J, Burke P, Feldman J, Agarwal S, Glantz A, Moyer P, Serino R, Hirsch E. The return of tourniquets: original research evaluates the effectiveness of prehospital tourniquets for civilian penetrating extremity injuries. *JEMS.* 2008;33:44–46, 49–50, 52, 54.
 62. Savvidis E, Parsch K. Prolonged transitory paralysis after pneumatic tourniquet use on the upper arm [in German]. *Unfallchirurg.* 1999;102:141–144.
 63. Kornbluth ID, Freedman MK, Sher L, Frederick RW. Femoral, saphenous nerve palsy after tourniquet use: a case report. *Arch Phys Med Rehabil.* 2003;84:909–911.
 64. Landi A, Saracino A, Pinelli M, Caserta G, Facchini MC. Tourniquet paralysis in microsurgery. *Ann Acad Med Singapore.* 1995;24(suppl):89–93.
 65. Wakai A, Wang JH, Winter DC, Street JT, O'Sullivan RG, Redmond HP. Tourniquet-induced systemic inflammatory response in extremity surgery. *J Trauma.* 2001;51:922–926.
 66. Mohler LR, Pedowitz RA, Lopez MA, Gershuni DH. Effects of tourniquet compression on neuromuscular function. *Clin Orthop Relat Res.* Feb 1999;213–220.
 67. Kokki H, Vaatainen U, Penttilä I. Metabolic effects of a low-pressure tourniquet system compared with a high-pressure tourniquet system in arthroscopic anterior cruciate ligament reconstruction. *Acta Anaesthesiol Scand.* 1998;42:418–424.
 68. King RB, Filipis D, Blitz S, Logsetty S. Evaluation of possible tourniquet systems for use in the Canadian Forces. *J Trauma.* 2006;60:1061–1071.
 69. Wenke JC, Walters TJ, Greydanus DJ, Pusateri AE, Convertino VA. Physiological evaluation of the U.S. Army one-handed tourniquet. *Mil Med.* 2005;170:776–781.
 70. Calkins D, Snow C, Costello M, Bentley TB. Evaluation of possible battlefield tourniquet systems for the far-forward setting. *Mil Med.* 2000;165:379–384.
 71. Walters TJ, Wenke JC, Kauvar DS, McManus JG, Holcomb JB, Baer DG. Effectiveness of self-applied tourniquets in human volunteers. *Prehosp Emerg Care.* 2005;9:416–422.
 72. Swan KG Jr, Wright DS, Barbagiovanni SS, Swan BC, Swan KG. Tourniquets revisited. *J Trauma.* 2009;66:672–675.
 73. Ersoy G, Kaynak MF, Yilmaz O, Rodoplu U, Maltepe F, Gokmen N. Hemostatic effects of microporous polysaccharide hemosphere in a rat model with severe femoral artery bleeding. *Adv Ther.* 2007;24:485–492.
 74. McManus J, Hurtado T, Pusateri A, Knoop KJ. A case series describing thermal injury resulting from zeolite use for hemorrhage control in combat operations. *Prehosp Emerg Care.* 2007;11:67–71.
 75. Rhee P, Brown C, Martin M, Salim A, Plurad D, Green D, Chambers L, Demetriades D, Velmahos G, Alam H. QuikClot use in trauma for hemorrhage control: case series of 103 documented uses. *J Trauma.* 2008;64:1093–1099.
 76. Wedmore I, McManus JG, Pusateri AE, Holcomb JB. A special report on the chitosan-based hemostatic dressing: experience in current combat operations. *J Trauma.* 2006;60:655–658.
 77. Dire DJ, Welsh AP. A comparison of wound irrigation solutions used in the emergency department. *Ann Emerg Med.* 1990;19:704–708.
 78. Moscati R, Mayrose J, Fincher L, Jehle D. Comparison of normal saline with tap water for wound irrigation. *Am J Emerg Med.* 1998;16:379–381.
 79. Bansal BC, Wiebe RA, Perkins SD, Abramo TJ. Tap water for irrigation of lacerations. *Am J Emerg Med.* 2002;20:469–472.
 80. Valente JH, Forti RJ, Freundlich LF, Zandieh SO, Crain EF. Wound irrigation in children: saline solution or tap water? *Ann Emerg Med.* 2003;41:609–616.
 81. Moscati RM, Mayrose J, Reardon RF, Janicke DM, Jehle DV. A multicenter comparison of tap water versus sterile saline for wound irrigation. *Acad Emerg Med.* 2007;14:404–409.
 82. Longmire AW, Broom LA, Burch J. Wound infection following high-pressure syringe and needle irrigation. *Am J Emerg Med.* 1987;5:179–181.
 83. Claus EE, Fusco CF, Ingram T, Ingersoll CD, Edwards JE, Melham TJ. Comparison of the effects of selected dressings on the healing of standardized abrasions. *J Athl Train.* 1998;33:145–149.
 84. Beam JW. Occlusive dressings and the healing of standardized abrasions. *J Athl Train.* 2008;43:600–607.
 85. Hinman CD, Maibach H. Effect of air exposure and occlusion on experimental human skin wounds. *Nature.* 1963;200:377–378.
 86. Huang HM, Wang JH, Yang L, Yi ZH. Effect of local treatment with cooling and spray film on early edema of superficial II degree scald burns in rats [in Chinese]. *Nan Fang Yi Ke Da Xue Xue Bao.* 2009;29:804–806.
 87. Cuttle L, Kempf M, Kravchuk O, Phillips GE, Mill J, Wang XQ, Kimble RM. The optimal temperature of first aid treatment for partial thickness burn injuries. *Wound Repair Regen.* 2008;16:626–634.
 88. Yuan J, Wu C, Holland AJ, Harvey JG, Martin HC, La Hei ER, Arbuckle S, Godfrey TC. Assessment of cooling on an acute scald burn injury in a porcine model. *J Burn Care Res.* 2007;28:514–520.
 89. Ofeigsson OJ, Mitchell R, Patrick RS. Observations on the cold water treatment of cutaneous burns. *J Pathol.* 1972;108:145–150.
 90. Nguyen NL, Gun RT, Sparnon AL, Ryan P. The importance of immediate cooling: a case series of childhood burns in Vietnam. *Burns.* 2002;28:173–176.
 91. Tung KY, Chen ML, Wang HJ, Chen GS, Peck M, Yang J, Liu CC. A seven-year epidemiology study of 12,381 admitted burn patients in Taiwan: using the Internet registration system of the Childhood Burn Foundation. *Burns.* 2005;31(suppl 1):S12–S17.
 92. Li C, Yu D, Li MS. Clinical and experiment study of cooling therapy on burned wound [in Chinese]. *Zhonghua Yi Xue Za Zhi.* 1997;77:586–588.
 93. Matthews RN, Radakrishnan T. First-aid for burns. *Lancet.* 1987;1:1371.
 94. Purdue GF, Layton TR, Copeland CE. Cold injury complicating burn therapy. *J Trauma.* 1985;25:167–168.
 95. Sawada Y, Urushidate S, Yotsuyanagi T, Ishita K. Is prolonged and excessive cooling of a scalded wound effective? *Burns.* 1997;23:55–58.
 96. Swain AH, Azadian BS, Wakeley CJ, Shakespeare PG. Management of blisters in minor burns. *BMJ (Clin Res Ed).* 1987;295:181.
 97. Cope O. The treatment of the surface burns. *Ann Surg.* 1943;117:885–893.
 98. Forage AV. The effects of removing the epidermis from burnt skin. *Lancet.* 1962;2:690–693.
 99. Gimbel NS, Kapetansky DI, Weissman F, Pinkus HK. A study of epithelization in blistered burns. *AMA Arch Surg.* 1957;74:800–803.
 100. Homma S, Gillam LD, Weyman AE. Echocardiographic observations in survivors of acute electrical injury. *Chest.* 1990;97:103–105.
 101. Jensen PJ, Thomsen PE, Bagger JP, Norgaard A, Baandrup U. Electrical injury causing ventricular arrhythmias. *Br Heart J.* 1987;57:279–283.

102. Lowery DW, Wald MM, Browne BJ, Tigges S, Hoffman JR, Mower WR. Epidemiology of cervical spine injury victims. *Ann Emerg Med.* 2001;38:12–16.
103. Stiell IG, Wells GA, Vandemheen KL, Clement CM, Lesiuk H, De Maio VJ, Laupacis A, Schull M, McKnight RD, Verbeek R, Brison R, Cass D, Dreyer J, Eisenhauer MA, Greenberg GH, MacPhail I, Morrison L, Reardon M, Worthington J. The Canadian C-spine rule for radiography in alert and stable trauma patients. *JAMA.* 2001;286:1841–1848.
104. Hackl W, Hausberger K, Sailer R, Ulmer H, Gassner R. Prevalence of cervical spine injuries in patients with facial trauma. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2001;92:370–376.
105. Kennedy E. *Spinal Cord Injury: The Facts and Figures.* Birmingham, Ala: University of Alabama Press; 1986.
106. Reid DC, Henderson R, Saboe L, Miller JD. Etiology and clinical course of missed spine fractures. *J Trauma.* 1987;27:980–986.
107. Davis JW, Phreaner DL, Hoyt DB, Mackersie RC. The etiology of missed cervical spine injuries. *J Trauma.* 1993;34:342–346.
108. Hauswald M, Ong G, Tandberg D, Omar Z. Out-of-hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998; 5:214–219.
109. Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI; National Emergency X-Radiography Utilization Study Group. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. *N Engl J Med.* 2000;343:94–99.
110. Viccellio P, Simon H, Pressman BD, Shah MN, Mower WR, Hoffman JR. A prospective multicenter study of cervical spine injury in children. *Pediatrics.* 2001;108:E20.
111. Touger M, Gennis P, Nathanson N, Lowery DW, Pollack CV Jr, Hoffman JR, Mower WR. Validity of a decision rule to reduce cervical spine radiography in elderly patients with blunt trauma. *Ann Emerg Med.* 2002;40:287–293.
112. Panacek EA, Mower WR, Holmes JF, Hoffman JR. Test performance of the individual NEXUS low-risk clinical screening criteria for cervical spine injury. *Ann Emerg Med.* 2001;38:22–25.
113. Pieretti-Vanmarcke R, Velmahos GC, Nance ML, Islam S, Falcone RA Jr, Wales PW, Brown RL, Gaines BA, McKenna C, Moore FO, Goslar PW, Inaba K, Barmparas G, Scaife ER, Metzger RR, Brockmeyer DL, Upperman JS, Estrada J, Lanning DA, Rasmussen SK, Danielson PD, Hirsh MP, Consani HF, Stylianios S, Pineda C, Norwood SH, Bruch SW, Drongowski R, Barraco MD, Pasquale MD, Hussain F, Hirsch EF, McNeely PD, Fallat ME, Foley DS, Iacono JA, Bennett HM, Waxman K, Kam K, Bakhos L, Petrovick L, Chang Y, Masiakos PT. Clinical clearance of the cervical spine in blunt trauma patients younger than 3 years: a multi-center study of the American Association for the Surgery of Trauma. *J Trauma.* 2009;67:543–549.
114. Domeier RM, Evans RW, Swor RA, Hancock JB, Fales W, Krohmer J, Frederiksen SM, Shork MA. The reliability of prehospital clinical evaluation for potential spinal injury is not affected by the mechanism of injury. *Prehosp Emerg Care.* 1999;3:332–337.
115. Cote DJ, Prentice WE Jr, Hooker DN, Shields EW. Comparison of three treatment procedures for minimizing ankle sprain swelling. *Phys Ther.* 1988;68:1072–1076.
116. Meeusen R, Lievens P. The use of cryotherapy in sports injuries. *Sports Med.* 1986;3:398–414.
117. Hocutt JE Jr, Jaffe R, Rylander CR, Beebe JK. Cryotherapy in ankle sprains. *Am J Sports Med.* 1982;10:316–319.
118. Airaksinen OV, Kyrklund N, Latvala K, Kouri JP, Gronblad M, Kolari P. Efficacy of cold gel for soft tissue injuries: a prospective randomized double-blinded trial. *Am J Sports Med.* 2003;31:680–684.
119. Basur RL, Shephard E, Mouzas GL. A cooling method in the treatment of ankle sprains. *Practitioner.* 1976;216:708–711.
120. Ayata R, Shiraki H, Fukuda T, Takemura M, Mukai N, Miyakawa S. The effects of icing after exercise on jumper's knee. *Jpn J Phys Fitness Sports Med.* 2007;56:125–130.
121. Merrick MA, Jutte LS, Smith ME. Cold modalities with different thermodynamic properties produce different surface and intramuscular temperatures. *J Athl Train.* 2003;38:28–33.
122. Dykstra JH, Hill HM, Miller MG, Cheatham CC, Michael TJ, Baker RJ. Comparisons of cubed ice, crushed ice, and wetted ice on intramuscular and surface temperature changes. *J Athl Train.* 2009;44: 136–141.
123. Kanlayanaphotporn R, Janwantanakul P. Comparison of skin surface temperature during the application of various cryotherapy modalities. *Arch Phys Med Rehabil.* 2005;86:1411–1415.
124. McMaster WC, Liddle S, Waugh TR. Laboratory evaluation of various cold therapy modalities. *Am J Sports Med.* 1978;6:291–294.
125. Chesterton LS, Foster NE, Ross L. Skin temperature response to cryotherapy. *Arch Phys Med Rehabil.* 2002;83:543–549.
126. Graham CA, Stevenson J. Frozen chips: an unusual cause of severe frostbite injury. *Br J Sports Med.* 2000;34:382–383.
127. Moeller JL, Monroe J, McKeag DB. Cryotherapy-induced common peroneal nerve palsy. *Clin J Sport Med.* 1997;7:212–216.
128. Bassett FH III, Kirkpatrick JS, Engelhardt DL, Malone TR. Cryotherapy-induced nerve injury. *Am J Sports Med.* 1992;20:516–518.
129. Bleakley CM, McDonough SM, MacAuley DC, Bjordal J. Cryotherapy for acute ankle sprains: a randomised controlled study of two different icing protocols. *Br J Sports Med.* 2006;40:700–705.
130. Auerbach PS, Gehr EC, Ryu RK. The Reel Splint: experience with a new traction splint apparatus in the prehospital setting. *Ann Emerg Med.* 1984;13:419–422.
131. Kaplan MM, Cohen D, Koprowski H, Dean D, Ferrigan L. Studies on the local treatment of wounds for the prevention of rabies. *Bull World Health Organ.* 1962;26:765–775.
132. Dean DJ, Baer GM, Thompson WR. Studies on the local treatment of rabies-infected wounds. *Bull World Health Organ.* 1963;28:477–486.
133. Callahan ML. Treatment of common dog bites: infection risk factors. *JACEP.* 1978;7:83–87.
134. Alberts MB, Shalit M, LoGalbo F. Suction for venomous snakebite: a study of “mock venom” extraction in a human model. *Ann Emerg Med.* 2004;43:181–186.
135. Lawrence WT, Giannopoulos A, Hansen A. Pit viper bites: rational management in locales in which copperheads and cottonmouths predominate. *Ann Plast Surg.* 1996;36:276–285.
136. Leopold RS, Huber GS. Ineffectiveness of suction in removing snake venom from open wounds. *U S Armed Forces Med J.* 1960;11:682–685.
137. Bush SP, Hegewald KG, Green SM, Cardwell MD, Hayes WK. Effects of a negative pressure venom extraction device (Extractor) on local tissue injury after artificial rattlesnake envenomation in a porcine model. *Wilderness Environ Med.* 2000;11:180–188.
138. Holstege CP, Singletary EM. Images in emergency medicine: skin damage following application of suction device for snakebite. *Ann Emerg Med.* 2006;48:105, 113.
139. Howarth DM, Southee AE, Whyte IM. Lymphatic flow rates and first-aid in simulated peripheral snake or spider envenomation. *Med J Aust.* 1994;161:695–700.
140. German BT, Hack JB, Brewer K, Meggs WJ. Pressure-immobilization bandages delay toxicity in a porcine model of eastern coral snake (*Micrurus fulvius fulvius*) envenomation. *Ann Emerg Med.* 2005;45: 603–608.
141. Bush SP, Green SM, Laack TA, Hayes WK, Cardwell MD, Tanen DA. Pressure immobilization delays mortality and increases intracompartmental pressure after artificial intramuscular rattlesnake envenomation in a porcine model. *Ann Emerg Med.* 2004;44:599–604.
142. Norris RL, Ngo J, Nolan K, Hooker G. Physicians and lay people are unable to apply pressure immobilization properly in a simulated snakebite scenario. *Wilderness Environ Med.* 2005;16:16–21.
143. Simpson ID, Tanwar PD, Andrade C, Kochar DK, Norris RL. The Ebbinghaus retention curve: training does not increase the ability to apply pressure immobilisation in simulated snake bite: implications for snake bite first aid in the developing world. *Trans R Soc Trop Med Hyg.* 2008;102:451–459.
144. Mianzan HW, Fenner PJ, Cornelius PF, Ramirez FC. Vinegar as a disarming agent to prevent further discharge of the nematocysts of the stinging hydromedusa *Olindias sambaquiensis*. *Cutis.* 2001;68:45–48.
145. Burnett JW, Rubinstein H, Calton GJ. First aid for jellyfish envenomation. *South Med J.* 1983;76:870–872.
146. Loten C, Stokes B, Worsley D, Seymour JE, Jiang S, Isbister GK. A randomised controlled trial of hot water (45 degrees C) immersion versus ice packs for pain relief in bluebottle stings. *Med J Aust.* 2006; 184:329–333.
147. Nomura JT, Sato RL, Ahern RM, Snow JL, Kuwaye TT, Yamamoto LG. A randomized paired comparison trial of cutaneous treatments for acute jellyfish (*Carybdea alata*) stings. *Am J Emerg Med.* 2002;20:624–626.
148. Yoshimoto CM, Yanagihara AA. Cnidarian (coelenterate) envenomations in Hawai'i improve following heat application. *Trans R Soc Trop Med Hyg.* 2002;96:300–303.
149. Atkinson PR, Boyle A, Hartin D, McAuley D. Is hot water immersion an effective treatment for marine envenomation? *Emerg Med J.* 2006;23: 503–508.

150. Thomas J. Dermatology in the new millennium. *Indian J Dermatol Venereol Leprol.* 2001;67:100–103.
151. Exton DR, Fenner PJ, Williamson JA. Cold packs: effective topical analgesia in the treatment of painful stings by Physalia and other jellyfish. *Med J Aust.* 1989;151:625–626.
152. Thomas CS, Scott SA, Galanis DJ, Goto RS. Box jellyfish (*Carybdea alata*) in Waikiki: the analgesic effect of sting-aid, Adolph's meat tenderizer and fresh water on their stings: a double-blinded, randomized, placebo-controlled clinical trial. *Hawaii Med J.* 2001;60:205–207, 210.
153. Pereira PL, Carrette T, Cullen P, Mulcahy RF, Little M, Seymour J. Pressure immobilisation bandages in first-aid treatment of jellyfish envenomation: current recommendations reconsidered. *Med J Aust.* 2000;173:650–652.
154. Seymour J, Carrette T, Cullen P, Little M, Mulcahy RF, Pereira PL. The use of pressure immobilization bandages in the first aid management of cubozoan envenomings. *Toxicol.* 2002;40:1503–1505.
155. Flores MT. Traumatic injuries in the primary dentition. *Dent Traumatol.* 2002;18:287–298.
156. Hiltz J, Trope M. Vitality of human lip fibroblasts in milk, Hanks balanced salt solution and Viaspan storage media. *Endod Dent Traumatol.* 1991;7:69–72.
157. Chan AW, Wong TK, Cheung GS. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. *Dent Traumatol.* 2001;17:77–85.
158. Sae-Lim V, Lim LP. Dental trauma management awareness of Singapore pre-school teachers. *Dent Traumatol.* 2001;17:71–76.
159. Greif R, Rajek A, Laciny S, Bastanmehr H, Sessler DI. Resistive heating is more effective than metallic-foil insulation in an experimental model of accidental hypothermia: a randomized controlled trial. *Ann Emerg Med.* 2000;35:337–345.
160. Steele MT, Nelson MJ, Sessler DI, Fraker L, Bunney B, Watson WA, Robinson WA. Forced air speeds rewarming in accidental hypothermia. *Ann Emerg Med.* 1996;27:479–484.
161. Mills WJ Jr, Whaley R, Fish W. Frostbite: experience with rapid rewarming and ultrasonic therapy: part II: 1960. *Alaska Med.* 1993;35:10–18.
162. Mills WJ Jr, Whaley R, Fish W. Frostbite: experience with rapid rewarming and ultrasonic therapy: part III: 1961. *Alaska Med.* 1993;35:19–27.
163. Fuhrman FA, Crismon JM. Studies on gangrene following cold injury: treatment of cold injury by means of immediate rapid warming. *J Clin Invest.* 1947;26:476–485.
164. Entin MA, Baxter H. Influence of rapid warming on frostbite in experimental animals. *Plast Reconstr Surg (1946).* 1952;9:511–524.
165. Fuhrman FA, Fuhrman GJ. The treatment of experimental frostbite by rapid thawing: a review and new experimental data. *Medicine (Baltimore).* 1957;36:465–487.
166. Malhotra MS, Mathew L. Effect of rewarming at various water bath temperatures in experimental frostbite. *Aviat Space Environ Med.* 1978;49:874–876.
167. Purkayastha SS, Chhabra PC, Verma SS, Selvamurthy W. Experimental studies on the treatment of frostbite in rats. *Indian J Med Res.* 1993;98:178–184.
168. Martinez Villen G, Garcia Bescos G, Rodriguez Sosa V, Morandeira Garcia JR. Effects of haemodilution and rewarming with regard to digital amputation in frostbite injury: an experimental study in the rabbit. *J Hand Surg Br.* 2002;27:224–228.
169. Purkayastha SS, Bhaumik G, Chauhan SK, Banerjee PK, Selvamurthy W. Immediate treatment of frostbite using rapid rewarming in tea decoction followed by combined therapy of pentoxifylline, aspirin & vitamin C. *Indian J Med Res.* 2002;116:29–34.
170. Bilgic S, Ozkan H, Ozenc S, Safaz I, Yildiz C. Treating frostbite. *Can Fam Physician.* 2008;54:361–363.
171. Sands WA, Kimmel WL, Wurtz BR, Stone MH, McNeal JR. Comparison of commercially available disposable chemical hand and foot warmers. *Wilderness Environ Med.* 2009;20:33–38.
172. Heggers JP, Robson MC, Manavalen K, Weingarten MD, Clinechers JM, Boertman JA, Smith DJ Jr, Sachs RJ. Experimental and clinical observations on frostbite. *Ann Emerg Med.* 1987;16:1056–1062.
173. McCauley RL, Hing DN, Robson MC, Heggers JP. Frostbite injuries: a rational approach based on the pathophysiology. *J Trauma.* 1983;23:143–147.
174. Twomey JA, Peltier GL, Zera RT. An open-label study to evaluate the safety and efficacy of tissue plasminogen activator in treatment of severe frostbite. *J Trauma.* 2005;59:1350–1354.
175. Foray J. Mountain frostbite: current trends in prognosis and treatment (from results concerning 1261 cases). *Int J Sports Med.* 1992;13(suppl 1):S193–S196.
176. Kenefick RW, O'Moore KM, Mahood NV, Castellani JW. Rapid IV versus oral rehydration: responses to subsequent exercise heat stress. *Med Sci Sports Exerc.* 2006;38:2125–2131.
177. Michell MW, Oliveira HM, Kinsky MP, Vaid SU, Herndon DN, Kramer GC. Enteral resuscitation of burn shock using World Health Organization oral rehydration solution: a potential solution for mass casualty care. *J Burn Care Res.* 2006;27:819–825.
178. Barclay RL, Depew WT, Vanner SJ. Carbohydrate-electrolyte rehydration protects against intravascular volume contraction during colonic cleansing with orally administered sodium phosphate. *Gastrointest Endosc.* 2002;56:633–638.
179. Currell K, Urch J, Cerri E, Jentjens RL, Blannin AK, Jeukendrup AE. Plasma deuterium oxide accumulation following ingestion of different carbohydrate beverages. *Appl Physiol Nutr Metab.* 2008;33:1067–1072.
180. Jeukendrup AE, Currell K, Clarke J, Cole J, Blannin AK. Effect of beverage glucose and sodium content on fluid delivery. *Nutr Metab (Lond).* 2009;6:9.
181. Evans GH, Shirreffs SM, Maughan RJ. Postexercise rehydration in man: the effects of osmolality and carbohydrate content of ingested drinks. *Nutrition.* 2009;25:905–913.
182. Greenleaf JE, Jackson CG, Geelen G, Keil LC, Hinghofer-Szalkay H, Whittam JH. Plasma volume expansion with oral fluids in hypohydrated men at rest and during exercise. *Aviat Space Environ Med.* 1998;69:837–844.
183. Maughan RJ, Leiper JB. Sodium intake and post-exercise rehydration in man. *Eur J Appl Physiol Occup Physiol.* 1995;71:311–319.
184. Merson SJ, Maughan RJ, Shirreffs SM. Rehydration with drinks differing in sodium concentration and recovery from moderate exercise-induced hypohydration in man. *Eur J Appl Physiol.* 2008;103:585–594.
185. Shirreffs SM, Taylor AJ, Leiper JB, Maughan RJ. Post-exercise rehydration in man: effects of volume consumed and drink sodium content. *Med Sci Sports Exerc.* 1996;28:1260–1271.
186. Clapp AJ, Bishop PA, Muir I, Walker JL. Rapid cooling techniques in joggers experiencing heat strain. *J Sci Med Sport.* 2001;4:160–167.
187. Clements JM, Casa DJ, Knight J, McClung JM, Blake AS, Meenen PM, Gilmer AM, Caldwell KA. Ice-water immersion and cold-water immersion provide similar cooling rates in runners with exercise-induced hyperthermia. *J Athl Train.* 2002;37:146–150.
188. Proulx CI, Ducharme MB, Kenny GP. Effect of water temperature on cooling efficiency during hyperthermia in humans. *J Appl Physiol.* 2003;94:1317–1323.
189. Armstrong LE, Crago AE, Adams R, Roberts WO, Maresh CM. Whole-body cooling of hyperthermic runners: comparison of two field therapies. *Am J Emerg Med.* 1996;14:355–358.
190. American Academy of Pediatrics Committee on Injury, Violence, and Poison Prevention. Prevention of drowning in infants, children, and adolescents. *Pediatrics.* 2003;112:437–439.
191. Suominen P, Baillie C, Korpela R, Rautanen S, Ranta S, Olkkola KT. Impact of age, submersion time and water temperature on outcome in near-drowning. *Resuscitation.* 2002;52:247–254.
192. Graf WD, Cummings P, Quan L, Brutocao D. Predicting outcome in pediatric submersion victims. *Ann Emerg Med.* 1995;26:312–319.
193. Modell JH, Idris AH, Pineda JA, Silverstein JH. Survival after prolonged submersion in freshwater in Florida. *Chest.* 2004;125:1948–1951.
194. Mehta SR, Srinivasan KV, Bindra MS, Kumar MR, Lahiri AK. Near drowning in cold water. *J Assoc Physicians India.* 2000;48:674–676.
195. Szpilman D, Soares M. In-water resuscitation: is it worthwhile? *Resuscitation.* 2004;63:25–31.
196. Latenser BA, Lucktong TA. Anhydrous ammonia burns: case presentation and literature review. *J Burn Care Rehabil.* 2000;21(part 1):40–42.
197. Wibbenmeyer LA, Morgan LJ, Robinson BK, Smith SK, Lewis RW II, Kealey GP. Our chemical burn experience: exposing the dangers of anhydrous ammonia. *J Burn Care Rehabil.* 1999;20:226–231.
198. Yano K, Hosokawa K, Kakibuchi M, Hikasa H, Hata Y. Effects of washing acid injuries to the skin with water: an experimental study using rats. *Burns.* 1995;21:500–502.
199. Kono K, Yoshida Y, Watanabe M, Tanioka Y, Dote T, Orita Y, Bessho Y, Yoshida J, Sumi Y, Umebayashi K. An experimental study on the treatment of hydrofluoric acid burns. *Arch Environ Contam Toxicol.* 1992;22:414–418.

200. Murao M. Studies on the treatment of hydrofluoric acid burn. *Bull Osaka Med Coll.* 1989;35:39–48.
201. Lorette JJ Jr, Wilkinson JA. Alkaline chemical burn to the face requiring full-thickness skin grafting. *Ann Emerg Med.* 1988;17:739–741.
202. Leonard LG, Scheulen JJ, Munster AM. Chemical burns: effect of prompt first aid. *J Trauma.* 1982;22:420–423.
203. Kompa S, Schareck B, Tymphner J, Wustemeyer H, Schrage NF. Comparison of emergency eye-wash products in burned porcine eyes. *Graefes Arch Clin Exp Ophthalmol.* 2002;240:308–313.
204. McCulley JP. Ocular hydrofluoric acid burns: animal model, mechanism of injury and therapy. *Trans Am Ophthalmol Soc.* 1990;88:649–684.
205. Hojer J, Personne M, Hulten P, Ludwigs U. Topical treatments for hydrofluoric acid burns: a blind controlled experimental study. *J Toxicol Clin Toxicol.* 2002;40:861–866.
206. Herr RD, White GL Jr, Bernhisel K, Mamalis N, Swanson E. Clinical comparison of ocular irrigation fluids following chemical injury. *Am J Emerg Med.* 1991;9:228–231.
207. Ingram TA III. Response of the human eye to accidental exposure to sodium hypochlorite. *J Endod.* 1990;16:235–238.
208. Burns FR, Paterson CA. Prompt irrigation of chemical eye injuries may avert severe damage. *Occup Health Saf.* 1989;58:33–36.
209. Kompa S, Redbrake C, Hilgers C, Wustemeyer H, Schrage N, Remky A. Effect of different irrigating solutions on aqueous humour pH changes, intraocular pressure and histological findings after induced alkali burns. *Acta Ophthalmol Scand.* 2005;83:467–470.
210. Spoler F, Frentz M, Forst M, Kurz H, Schrage NF. Analysis of hydrofluoric acid penetration and decontamination of the eye by means of time-resolved optical coherence tomography. *Burns.* 2008;34:549–555.
211. Rihawi S, Frentz M, Schrage NF. Emergency treatment of eye burns: which rinsing solution should we choose? *Graefes Arch Clin Exp Ophthalmol.* 2006;244:845–854.
212. Homan CS, Maitra SR, Lane BP, Geller ER. Effective treatment of acute alkali injury of the rat esophagus with early saline dilution therapy. *Ann Emerg Med.* 1993;22:178–182.
213. Homan CS, Maitra SR, Lane BP, Thode HC, Sable M. Therapeutic effects of water and milk for acute alkali injury of the esophagus. *Ann Emerg Med.* 1994;24:14–20.
214. Homan CS, Maitra SR, Lane BP, Thode HC Jr, Davidson L. Histopathologic evaluation of the therapeutic efficacy of water and milk dilution for esophageal acid injury. *Acad Emerg Med.* 1995;2:587–591.
215. Homan CS, Singer AJ, Henry MC, Thode HC Jr. Thermal effects of neutralization therapy and water dilution for acute alkali exposure in canines. *Acad Emerg Med.* 1997;4:27–32.
216. Homan CS, Singer AJ, Thomajan C, Henry MC, Thode HC Jr. Thermal characteristics of neutralization therapy and water dilution for strong acid ingestion: an in-vivo canine model. *Acad Emerg Med.* 1998;5:286–292.
217. Spiller HA, Rodgers GC Jr. Evaluation of administration of activated charcoal in the home. *Pediatrics.* 2001;108:E100.
218. Lamminpää A, Vilska J, Hoppu K. Medical charcoal for a child's poisoning at home: availability and success of administration in Finland. *Hum Exp Toxicol.* 1993;12:29–32.
219. Donoso A, Linares M, Leon J, Rojas G, Valverde C, Ramirez M, Oberpaur B. Activated charcoal laryngitis in an intubated patient. *Pediatr Emerg Care.* 2003;19:420–421.
220. Dorrington CL, Johnson DW, Brant R. The frequency of complications associated with the use of multiple-dose activated charcoal. *Ann Emerg Med.* 2003;41:370–377.
221. Givens T, Holloway M, Wason S. Pulmonary aspiration of activated charcoal: a complication of its misuse in overdose management. *Pediatr Emerg Care.* 1992;8:137–140.
222. Scharman EJ, Cloonan HA, Durback-Morris LF. Home administration of charcoal: can mothers administer a therapeutic dose? *J Emerg Med.* 2001;21:357–361.
223. Kulig K, Bar-Or D, Cantrill SV, Rosen P, Rumack BH. Management of acutely poisoned patients without gastric emptying. *Ann Emerg Med.* 1985;14:562–567.
224. Pond SM, Lewis-Driver DJ, Williams GM, Green AC, Stevenson NW. Gastric emptying in acute overdose: a prospective randomised controlled trial. *Med J Aust.* 1995;163:345–349.
225. Caravati EM. Unintentional acetaminophen ingestion in children and the potential for hepatotoxicity. *J Toxicol Clin Toxicol.* 2000;38:291–296.
226. Bond G. Home syrup of ipecac use does not reduce emergency department use or improve outcome. *Pediatrics.* 2003;112:1061–1064.
227. Kornberg AE, Dolgin J. Pediatric ingestions: charcoal alone versus ipecac and charcoal. *Ann Emerg Med.* 1991;20:648–651.
228. Czajka PA, Russell SL. Nonemetic effects of ipecac syrup. *Pediatrics.* 1985;75:1101–1104.

KEY WORDS: emergency ■ injury

Correction

In the article by Markenson et al, “Part 17: First Aid: 2010 American Heart Association and American Red Cross Guidelines for First Aid,” which published online October 18, 2010, and appeared with the November 2, 2010, issue of the journal (*Circulation*. 2010;122(suppl 3):S934–S946), several corrections were needed.

On page S935, in the Table, the American Safety & Health Institute (ASHI) and Medic First Aid International should be listed as members of the International First Aid Science Advisory Board Member Organizations. The word “(Observer)” has been deleted from both entries.

The American Heart Association and the American Red Cross regret listing these organizations as observers.

These corrections have been made to the current online version of the article, which is available at http://circ.ahajournals.org/cgi/reprint/122/18_suppl_3/S934.

DOI: 10.1161/CIR.0b013e318205da55