

ELSEVIER

# Heart Smarter

**EMS Implications of the  
2005 AHA Guidelines  
for ECC & CPR**



**JEMS**  
JOURNAL OF EMERGENCY MEDICAL SERVICES

An **exclusive supplement** to **JEMS (Journal of Emergency Medical Services)**  
sponsored by The American Heart Association, Laerdal Medical Corp., Medtronic,  
Philips Medical Systems & ZOLL Medical Corp.

# Heart Smarter

## EMS Implications of the 2005 AHA Guidelines for ECC & CPR

21



PHOTO CRAIG JACKSON

**For older children**, the emphasis is on achieving adequate compression depth with minimal interruptions, using one or two hands according to rescuer preference.

### 4 Contributors

### 6 From the Editor

*By A.J. Heightman, MPA, EMT-P*

### the GUIDELINES

*By Jerry Potts, PhD,  
Tom P. Aufderheide, MD, FACEP,  
Todd J. Crocco, MD, John Field, MD,  
Louis Gonzales, EMT-P,  
Mary Fran Hazinski, RN, MSN,  
Edward C. Jauch, MD, &  
Arno Zaritsky, MD*

### 6 What's New & Why

### 8 Summary of Major Changes

### 12 Revising Your Protocols

### 29 Lay Rescuer AED Programs & the 2005 Guidelines for ECC & CPR

*Plus ... Frequently Asked Questions  
for Program Directors  
By Mary Newman*

**On the cover:** Seattle F.D. paramedics and firefighters deliver **uninterrupted compressions** while ventilating, administering medication and interpreting the cardiac rhythm.

PHOTO JONNY LAYEFSKY

**Vice President/Publisher** Jeff Berend  
**Advertising Director** Judi Leidiger  
**Director of Print & Electronic Publishing** Tim Francis  
**Editor-in-Chief** A.J. Heightman  
**Supplement Editor** Keri Losavio  
**Art Director** Joe Camacho

**Heart Smarter** is an editorial supplement sponsored by The American Heart Association, Laerdal Medical Corp., Medtronic, Philips Medical Systems & ZOLL Medical Corp. and published by Elsevier/Jems Communications, 525 B Street, Ste. 1900, San Diego, CA 92101-4495; 800/266-5367 (Fed. ID #13-935377).

**Copyright 2006** Elsevier Inc. No material may be reproduced or uploaded on computer network services without the expressed permission of the publisher.

**Subscription information:** To subscribe to a Jems/Elsevier publication, visit [www.jems.com](http://www.jems.com). **Advertising information:** Rates are available on request. Contact Jems Communications, Advertising Department, 525 B Street, Ste. 1900, San Diego, CA 92101-4495; 800/266-5367.



# Contributors

**Jerry Potts, PhD**, is the director of science for the American Heart Association's Emergency Cardiovascular Care Programs.



Dr. Potts holds a doctorate in cellular and molecular physiology. For the past nine years, Dr. Potts has focused his

knowledge of cardiovascular physiology on improving survival from life-threatening cardiovascular emergencies. His interest in the practical application of emergency cardiovascular care comes from his experience as an EMT during and after his undergraduate training. Contact him via e-mail at [jerry.potts@heart.org](mailto:jerry.potts@heart.org).

**Tom P. Aufderheide, MD, FACEP**, is a professor of emergency medicine at the Medical College of Wisconsin in Milwaukee. He



founded and directs the Resuscitation Research Center in the Department of Emergency Medicine. Currently a

member of the BLS Subcommittee for the National AHA's ECC Programs, Dr. Aufderheide has held various leadership positions with the AHA over the past 15 years, including BLS science editor and chair of the BLS Subcommittee.

**Todd J. Crocco, MD**, is an associate professor and vice chairman of the Department of Emergency Medicine at West Virginia



University. He also serves as the assistant medical director for the HealthNet Air Medical Transport Program for

West Virginia University Hospitals. Dr. Crocco has served as co-chair of the American Stroke Association Advisory Writing Group for EMS Continuing Medical Education on Stroke and is a member of the AHA's ECC Committee. Dr. Crocco also has ongoing research programs in, both, basic and clinical sciences studying the emergency treatment of acute stroke. He has provided his expertise in these areas for the development of the 2005 ECC Guidelines.

**John Field, MD**, is a professor of medicine and surgery in the Division of Cardiology at The Pennsylvania State University, Hershey. He is board certified in internal medicine, cardiovascular care (cardiology), critical care medicine and emergency medicine. Dr. Field



is also a senior science editor for the AHA's ECC Programs. He has contributed significantly to the 2000 and 2005 Guidelines, as well as to ACLS training materials during the past 10 years.

**Louis Gonzales, EMT-P**, has been active as a field EMS provider and educator for nearly 20 years. He currently serves as commander of the Clinical Practices Division of Williamson County EMS in Georgetown, Texas, and adjunct faculty in the Department



of EMS Professions for Temple College, Temple, Texas. His involvement in the AHA's ECC Programs include past membership on the ECC Committee, National First Aid Science Advisory Board and First Aid Task Force. He currently serves as the senior oversight editor for student training materials for AHA ECC Programs.

**Mary Fran Hazinski, RN, MSN**, is a clinical specialist in the Pediatric Emergency and Critical Care Department at Vanderbilt



Children's Hospital. She is also a senior science editor for the AHA's ECC Programs and has served as the co-chair of the AHA ECC Committee and its Pediatric Subcommittee. She was an editor of the 2000 Guidelines and has contributed to ECC Guidelines and training materials for over 15 years. Her clinical research has focused on pediatric critical care, child safety and use of AEDs for pediatric patients.

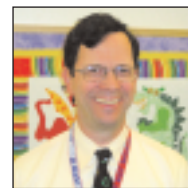
**Edward C. Jauch, MD, MS, FACEP**, is an assistant professor of emergency medicine at the University of Cincinnati College of



Medicine, the associate director of research for the Department of Emergency Medicine and a member of the Greater Cincinnati/Northern Kentucky Stroke Team. Dr. Jauch's primary area of research is in the identification and development of biomarkers in acute stroke and traumatic brain injury. He is past chair of the Society of Academic Emergency

Medicine Neurologic Emergencies Interest Group, and the ACEP representative to the Ohio Department of Health Council on Stroke Education and Prevention and to the AHA Comprehensive Stroke Center Committee. Dr. Jauch is actively involved with the AHA sitting on the Stroke Leadership Council, Scientific Committee, and co-chairs the Stroke Subcommittee of the ECC.

**Arno Zaritsky, MD**, serves as professor and chief, pediatric critical care, at the University of Florida College of Medicine. Dr.



Zaritsky is a founding member and the current chair of the AHA's ECC Pediatric Subcommittee. He was an organizer of the First

International Conference on Pediatric Resuscitation, sponsored by the AAP and AHA (1994) and chaired the Pediatric Utstein Consensus Panel in that same year. These activities directly contributed to the development and publication of the first pediatric resuscitation guidelines in 1986, as well as their 1992, 2000 and 2005 revisions. Dr. Zaritsky is also credited as a co-author of the first PALS course curriculum, and as the lead author and editor for the 2000 PALS Guidelines and the 2002 revisions to the PALS course materials. Most recently, Dr. Zaritsky served as one of two evidence evaluation experts for the "2005 Consensus on Science" process, making a significant contribution to the resuscitation guidelines developed by organizations worldwide.

**Mary Newman** is executive director of the SCA Network. She previously served as executive director of the National Center for Early



Defibrillation and on faculty at the University of Pittsburgh School of Medicine, cardiac arrest researcher at the Krannert Institute of Cardiology at Indiana University School of Medicine, and founding editor of the Citizen CPR Foundation and AHA publication *Currents in Emergency Cardiac Care*. She is the author of *Challenging Sudden Death: A Community Guide to Help Save Lives*, and has been a JEMS contributing editor since 1980. Contact her via e-mail at [mnewman513@mac.com](mailto:mnewman513@mac.com).



# New Approach to Cardiac Incident Management

The 2005 American Heart association Guidelines for ECC & CPR are a milestone in the history of EMS, not just because of the amount of science and EMS input involved in their development, but because there's an important operational message in their content.

With the heavy emphasis placed on improved technique and synchronization of CPR performance, quality of CPR, limiting ventilations and maintaining compressions, the message for EMS providers is that a cardiac arrest must now be managed using the same incident management approach we use at other major EMS incidents.

In the case of a cardiac arrest, CPR IMS doesn't just stand for incident management system. It stands for *Inflation and ventilation control; Maintaining compressions with as few*

*interruptions as possible; and Synchronizing and choreographing the CPR process.*

The CPR incident commander should have a CPR incident management sheet that stresses important ECC parameters. *Some examples:* 1) Keep compressions going at all costs, even if it means refraining from intubating. Compressions should not be interrupted for more than 10 seconds. When a crew stops compressions for any reason, the CPR IC should alert the crew at the five second mark that they have five seconds to begin

compressions. 2) Be vigilant about maintaining ventilations at the new rate and volume. Make sure the rescuer is not over-ventilating the patient. With an advanced airway in place, the rate is now just one breath every six to eight seconds, with each breath to last one complete second. Therefore, those patients can be ventilated just once every 10 compressions without pausing. 3) The compression role must be switched every two minutes so the quality of CPR doesn't diminish.

New devices will help you perform better CPR. But without a CPR IMS system, you will not be able to maintain the synchronized performance of CPR that current science recommends.

—A.J. Heightman, MPA, EMT-P,  
Editor-in-Chief, JEMS

## What's New & Why

For more than 30 years, the American Heart Association has published cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) guidelines for health-care and lay providers.

In 1974, at the time of the first publication, the scope of practice for prehospital emergency personnel was still quite limited for providers in about half of the states,<sup>1</sup> and the term EMT-paramedic had not yet been made an "official" category of health-care provider by the federal government. (The Department of Health Education and Welfare and the Department of Transportation adopted the term in 1975.) There was a growing awareness of such programs, buoyed by the 1974 *60 Minutes* story calling Seattle "the best place to have a heart attack" and describing the city's Medic One program, and, of course, by the hit television series *Emergency!* (1972–1977). Nonetheless, publication of the 1974 Guidelines occurred in the context of a relatively new prehospital health-care profession. It is no surprise that the AHA Guidelines of that day focused on in-hospital care and provided little explicit reference to Guideline implementation in the EMS environment.

Through the past three decades, pre-hospital care has advanced greatly in the U.S. and become a model for other countries that have also implemented non-physician-based EMS systems. Along with EMS systems, the AHA Guidelines have evolved, becoming more relevant to the prehospital provider.

That is not to say that these two evolutionary processes have been, at all times, coordinated. Even as recently as the 2000 Guidelines, recommendations were made that were not easily applied to the less controlled environment in which EMS personnel operate. For example, the formulation (and price) of amiodarone in 2000, made it difficult to administer (and justify adding to the drug bag of every EMS vehicle), setting aside any other controversy related to the drug. Even though previous recommendations for high-dose epinephrine were applicable to all health-care providers, that recommendation in 2000 also caused some difficulty for EMS providers.

The 2005 Guidelines, on the other hand, reflect a greater awareness of the prehospital provider than any previous versions.<sup>2</sup> Of course, this was not by accident. A concerted effort was made by the AHA to include pre-hospital organizations and individuals in its Emergency Cardiovascular Care Committee and the near-perpetual guideline development process.

The 2005 Guidelines are based on an extensive, rigorous review of resuscitation science, undertaken by the International Liaison Committee on Resuscitation, of which the AHA is a founding member.

Details of the evidence evaluation process are described in an editorial by Zaritsky and Morley that accompanied ILCOR's 2005 Consensus on Science, published concurrent with the electronic version of the AHA 2005 Guidelines.<sup>3</sup> Perhaps just as notable as the scope of the consensus process is the unprecedented attention that was given to managing potential conflicts of interest. Details of that process are described in an editorial by Billi et al, which accompanies the 2005 Guidelines publication (pp. 204–205).

In this supplement, we highlight changes to the AHA Guidelines for CPR and ECC that affect EMS providers. Some of the recommendations are directly related to resuscitation protocols that you use. Other recommendations are directed at lay providers, or 9-1-1 dispatchers and EMS systems. These changes are presented because they have the potential to impact specific actions taken by you on scene or the protocols for treatment and operations that are used in your particular EMS system.

## REFERENCES

1. JAMA. 227(7, Supplement):837–840, Feb. 18, 1974.
2. Circulation. 112(24, Supplement): Dec. 13, 2005. [http://circ.ahajournals.org/content/vol112/24\\_suppl/](http://circ.ahajournals.org/content/vol112/24_suppl/).
3. Circulation. 112(22, Supplement): Nov. 29, 2005. [http://circ.ahajournals.org/content/vol112/22\\_suppl/](http://circ.ahajournals.org/content/vol112/22_suppl/).

# Summary of Major Changes

The 2005 Guidelines place great emphasis on improving the quality of CPR delivered by all providers and on increasing the chance that a cardiac arrest victim will receive bystander CPR; both are attempts to improve the outcomes of cardiovascular medical emergencies. The following list summarizes the changes that are of significance to EMS providers, dispatchers and system administrators. To enable further research, we direct you to specific pages of the 2005 Guidelines in *Circulation*, where expanded discussions of these topics can be found.

## EMS PROVIDERS—BLS

- Focus on providing high-quality CPR with special attention to chest compression depth and rate, permitting complete chest wall recoil and minimal interruptions to compressions (pp. 25–26).
- All rescuers acting alone should use a 30:2 ratio of compressions-to-ventilations for all victims *except* newborns (pp. 26–27, 160–161).
- Health-care providers performing two-rescuer CPR for adults should use a 30:2

compression-to-ventilation ratio when there is no advanced airway in place (pp. 26–27).

- Health-care providers performing two-rescuer CPR for infants and children should use a 15:2 compression-to-ventilation ratio when there is no advanced airway in place (p. 161).
- Compressions are given at a rate of 100 per minute with complete relaxation of pressure on the chest wall after each compression (pp. 26, 160).
- Once an advanced airway is in place

(e.g., endotracheal tube, CombiTube or LMA), continuous chest compressions are given at 100/minute with one ventilation every six to eight seconds (8–10 ventilations per minute). The ventilations are given without pausing chest compressions (pp. 26–27, 160–161).

- Each rescue breath should be given over one second (pp. 23, 159).
- If a jaw thrust without head extension does not open the airway for an unresponsive trauma victim with suspected cervical spine injury, use the head tilt–chin lift maneuver (pp. 21–22, 157–158).
- Assessing breathing (pp. 22–23, 158)—Basic health-care providers check for “adequate” breathing in adults and “presence or absence” of breathing in infants and children before giving rescue breaths. Advanced providers look for “adequate” breathing in victims of all ages and are prepared to support oxygenation and ventilation.



This San Diego FD team conducts **coordinated resuscitation efforts** with one person in charge of overall care delivery while others are assigned to airway control, preparation and delivery of medications, and uninterrupted rotation of compression performance every two minutes.

- For infant and child victims, health-care providers may, if needed, try “a couple of times” to reopen the airway and deliver effective breaths (i.e., breaths that produce visible chest rise) (p. 158).
- Avoid over-ventilation: too many breaths per minute or breaths that are too large or too forceful (pp. 23, 159).
- Use a child dose-reduction system with AEDs (e.g., pediatric pads/cable), when available, for children from one to eight years old (p. 162).
- When two or more health-care providers are present during CPR, rescuers should rotate the compressor role every two minutes (pp. 26, 161).
- For victims of ventricular fibrillation (VF) cardiac arrest, use a single shock, followed by immediate CPR for two minutes, starting with compressions first (p. 36).
- Actions for foreign body airway obstruction (FBAO) relief were simplified (pp. 28–29, 162).
- In the event that a lone health-care provider discovers an unresponsive person and there is no one to send to activate the emergency response number, the sequence of actions should be tailored for the most likely cause of arrest in victims of all ages (pp. 21, 157): “Phone first,” get the AED and return to start CPR and use the AED for all adults and any children who experience out-of-hospital sudden collapse. “CPR first” (provide about five cycles or two minutes of CPR before activating the emergency response number) for unresponsive infants and children (except infants and children with sudden, witnessed collapse) and for all victims (including adults) of likely hypoxic arrest (e.g., drowning, injury, drug overdose).
- During two-rescuer CPR of an adult, child or infant with an advanced airway in place, the rescuer providing rescue breaths gives one breath about every six to eight seconds (8–10 breaths/minute) while the compressions are delivered continuously, at 100/minute, without pauses for ventilation (rather than in cycles of compressions with pauses for two rescue breaths) (pp. 23, 159).
- For adult out-of-hospital cardiac arrest that is not witnessed by the EMS provider, rescuers *may* give a period of CPR (about two minutes) before checking the rhythm and attempting defibrillation (pp. 27, 35).

## EMS PROVIDERS—ACLS

- Recommended use of endotracheal (ET) intubation is limited to providers with adequate training and opportunities to practice or perform intubations. Increased information about use of LMA and esophageal-tracheal combitube (CombiTube) is also included in the guidelines (pp. 52–55).
- Confirmation of ET tube placement requires both clinical assessment and use of a device (e.g., exhaled CO<sub>2</sub> detector, esophageal detector device). Use of a device is part of primary confirmation of tube placement and is no longer characterized as secondary confirmation (p. 54).
- Intravenous or intraosseous (IO) drug administration is preferred to endotracheal administration (p. 58).
- General concepts of treating pulseless arrest (i.e., VF/pulseless VT, asystole and PEA) (pp. 58–61):
  - a. BLS skills, including effective chest compressions with minimal interruptions, are the priority skills and interventions for cardiac arrest.
  - b. Insertion of an advanced airway may not be a high priority.
  - c. Organize care to minimize interruptions in chest compressions for rhythm check, shock delivery, advanced airway insertion or vascular access.
- Treatment of VF or pulseless VT (pp. 59–63):
  - a. To attempt defibrillation, deliver one shock (using monophasic or biphasic waveforms) followed immediately by CPR (beginning with chest compressions). Do not attempt to palpate a pulse or check the rhythm after shock delivery.
  - b. After about two minutes of CPR if an organized rhythm is apparent during rhythm check, the provider checks a pulse.
  - c. With a biphasic defibrillator (pp. 36), it is reasonable to use selected energies of 150 J to 200 J with a biphasic truncated exponential waveform or 120 J with a rectilinear biphasic waveform for the initial shock. For second and subsequent shocks, use the same or higher energy. If you are operating a manual biphasic defibrillator and are unaware of the effective dose range for that device to terminate VF, you may use a selected dose of 200 J



PHOTO TOM PAGE

This crew is ventilating **without pausing compressions**, delivering just eight ventilations per minute.

- a. for the first shock and an equal or higher dose for the second and subsequent shocks.
- d. With a monophasic defibrillator (pp. 36), select a dose of 360 J for all shocks.
- e. Drugs should be delivered during CPR, as soon as possible after rhythm checks. If a third rescuer is available, that rescuer should prepare drug doses before they are needed. If a rhythm check shows persistent VF/VT, the appropriate vasopressor or antiarrhythmic should be administered as soon as possible after the rhythm check. It can be administered during the CPR that precedes (until the defibrillator is charged) or follows the shock delivery. *The timing of drug delivery is less important than is the need to minimize interruptions in chest compressions.*
- f. Vasopressors are administered when an IV/IO line is in place, typically if VF or pulseless VT persists after the first or second shock. Epinephrine may be given every three to five minutes. A single dose of vasopressin may be given to replace either the first or second dose of epinephrine.
- g. Antiarrhythmics may be considered after the first dose of vasopressors (typically if VF or pulseless VT persists after the second or third shock). Amiodarone is preferred to lidocaine, but either is acceptable.





The use of **continuous EtCO<sub>2</sub> monitoring** via a digital readout on the ECG monitor assures the crew that CO<sub>2</sub> is passing through the ET tube.

- Treatment of asystole/pulseless electrical activity: Epinephrine may be administered every three to five minutes. One dose of vasopressin may replace either the first or the second dose of epinephrine (pp. 61–63).
- Treatment of symptomatic bradycardia: The recommended atropine dose is now 0.5 mg IV, which may be repeated to a total of 3 mg (pp. 68–69).
- Treatment of symptomatic tachycardia: A single, simplified algorithm includes some, but not all, drugs that may be administered. The algorithm indicates therapies intended for use in the in-hospital setting with expert consultation available (pp. 69–76).
- Initial general therapy for acute coronary syndrome (ACS) (pp. 89–93):
  - a. Administer **oxygen** to all patients with overt pulmonary congestion or arterial oxygen saturation <90%.
  - b. Unless the patient has a known **aspirin** allergy, administration of a single chewed dose of aspirin (160–325 mg) is recommended for all patients with suspected ACS, as soon as possible.
  - c. Patients with ischemic discomfort may receive sublingual or aerosol **nitroglycerin**, repeated twice at five-minute intervals until pain is relieved or low blood pressure limits its use.

- d. Administer **morphine sulfate** for continuing pain unresponsive to nitrates. Start with a 2–4 mg IV dose, and give additional doses of 2–8 mg IV at five- to 15-minute intervals.

## EMS PROVIDERS—PALS

- Apply health-care provider “child” CPR guidelines to victims from one year of age to the onset of puberty (previously, they were applicable for ages one to eight years) (p. 157).
- Confirming ET tube placement requires clinical assessment (e.g., visualization of vocal cords and auscultation of bilateral breath sounds) and detection of exhaled carbon dioxide (CO<sub>2</sub>) (p. 169).
- Confirmation of ET tube placement must be verified when the tube is inserted, during transport and whenever the patient is moved (p. 181).
- Esophageal detector devices may be used in children weighing > 20 kg who have a perfusing rhythm (p. 169).
- An LMA is an acceptable alternative to establish a “protected” airway when used by experienced providers (p. 167).
- During two-rescuer CPR of a child or infant with an advanced airway in place, the rescuer providing rescue breaths gives one breath about every six to eight seconds (8–10 breaths per minute) while the compressions are delivered continuously at 100/minute without pauses for ventilation (pp. 168, 175).
- Vascular routes (IV/IO) are preferred to endotracheal drug administration (p. 170).
- IO placement is an acceptable alternative for vascular access in children of all ages (p. 170).
- Timing of one shock, CPR and drug administration during pulseless arrest has changed and now is identical to that for ACLS (pp. 174–175).
- Routine use of high-dose epinephrine is not recommended (p. 174).
- Vasopressin is not recommended in pediatric cardiac arrest (p. 172).
- Lidocaine is deemphasized and amiodarone is considered the drug of choice for shock-refractory VF/pulseless VT, but lidocaine can be used for treatment if amiodarone is not available (pp. 171–172).
- Termination of resuscitative efforts is discussed in the Guidelines. Although previously used as an

indicator of futility, there are reports of intact survival following prolonged resuscitation and absence of spontaneous circulation despite two doses of epinephrine (pp. 7, 181).

## EMS DISPATCHERS & SYSTEM ADMINISTRATORS

- Dispatchers should receive appropriate training in providing prearrival telephone CPR instructions to callers (p. 20).
- Dispatchers who provide telephone CPR instructions to bystanders treating children and adult victims with a high likelihood of an asphyxial cause of arrest (e.g., drowning) should give directions for rescue breathing followed by chest compressions. In cases that are likely sudden cardiac arrest (SCA), telephone instruction in chest compressions alone may be preferable (pp. 20, 27).
- Dispatcher CPR instruction programs should develop strategies to help bystanders identify patients with occasional gasps as likely victims of cardiac arrest (p. 20).
- The EMS system’s quality improvement program should include periodic review of the dispatcher CPR instructions provided to specific callers (p. 20).
- Dispatchers should advise patients (with no history of aspirin allergy or signs of active or recent gastrointestinal bleeding) to chew an aspirin (160–325 mg) while awaiting the arrival of EMS providers (p. 91).
- EMS system medical directors may consider implementing a protocol that would allow EMS responders to provide about five cycles (about two minutes) of CPR before attempted defibrillation when the EMS system call-to-response interval is longer than four to five minutes (p. 35).
- Prehospital 12-lead ECG (p. 91):
  - a. Implementation of out-of-hospital 12-lead ECG diagnostic programs is recommended for urban and suburban EMS systems.
  - b. Routine use of 12-lead out-of-hospital ECG and advance notification is recommended for patients with signs and symptoms of acute coronary syndromes (ACS).
  - c. It is recommended that paramedics acquire and transmit either diagnostic-quality ECGs or their interpretation of them to the receiving hospital prior to arrival.

- Out-of-hospital administration of fibrinolytics to patients with ST-elevation myocardial infarction (STEMI) (pp. 91–92):
  - a. Given the operational challenges required to provide out-of-hospital fibrinolytics, most EMS systems should focus on early diagnosis with 12-lead ECG, rapid transport and advance notification of the ED (verbal interpretation or direct transmission of ECG) instead of prehospital delivery of fibrinolytic agents.
  - b. Prehospital fibrinolytic agent administration is, however, safe (assuming no contraindications), feasible and reasonable and may be performed by trained paramedics, nurses and physicians for patients with symptom duration of 30 minutes to six hours.
  - c. If such a program is implemented, system requirements include protocols with fibrinolytic checklists detailing indications and contraindications; ECG acquisition and interpretation; experience in advanced ACLS; the ability to communicate with the receiving institution; a medical director with training/experience in management of STEMI; and a process of continuous quality improvement.
- Out-of-hospital triage of suspected or confirmed STEMI (p. 92): At this time

there is inadequate evidence to recommend out-of-hospital triage to bypass hospitals that cannot provide percutaneous coronary intervention (PCI) to bring patients to a PCI center. Local protocols for EMS providers are appropriate to guide the destination of patients with suspected or confirmed STEMI.

- Stroke patients who require hospitalization should be admitted to a facility with a dedicated stroke unit (staffed by a multidisciplinary team experienced in managing stroke), when one is available within a reasonable transport interval (pp. 21, 111–113).
- Improvement in response intervals should be made, when feasible (p. 19).

### LAY RESCUERS

- In the unresponsive victim who is not moving, do not check for signs of circulation. After delivery of two rescue breaths, immediately begin chest compressions (and cycles of compressions and rescue breaths) (pp. 21–27).
- Do not deliver rescue breathing without compressions (pp. 25–27).
- Use a 30:2 compression:ventilation ratio and a compression rate of 100/minute for victims of all ages.
- When recommended by an AED, lay rescuers should deliver one shock followed by immediate CPR beginning

with chest compressions. All rescuers should allow the AED to check the victim's rhythm again after about five cycles (about two minutes) of CPR (p. 36).

- Continue AED/CPR cycles until the person is awake or until EMS takes over (p. 36).
- For the lay rescuer, a child is defined as up to eight years old, which is different from the definition used by health-care providers (i.e., up until the victim has signs of puberty) (pp. 13, 157). If alone with an unresponsive infant or child, give about five cycles of compressions and ventilations (about two minutes) before leaving the child to phone 9-1-1 (pp. 14, 157).
- Do not try to open the airway using a jaw thrust for injured victims—use the head tilt–chin lift for all victims (pp. 21, 157).
- First aid providers may help victims with asthma use an inhaler prescribed by a physician (p. 197).
- First aid providers may help victims with a bad allergic (anaphylactic) reaction use a prescribed epinephrine auto-injector. The first aid provider may administer the epinephrine if the provider is trained to do so, the state law allows it, and the victim is unable to administer it (p. 197).



PHOTO TOM PAGE

**Confirmation of ET tube placement** requires both clinical assessment and use of a CO<sub>2</sub> detector or EDD. Use of such a device is now part of primary confirmation of tube placement and is no longer characterized as secondary confirmation.



# Revising Your Protocols

Now that we've reviewed specific 2005 CPR and ECC Guidelines changes that affect EMS, it's time to address ways to incorporate these changes into your protocols. Below, we discuss recommended changes for EMS providers, dispatchers and system administrators, as well as layperson training and procedures.

## BASIC LIFE SUPPORT

**Compressions:** The 2005 recommendations for compressions have, sometimes, been summarized as, "Push hard, push fast, allow the chest to fully recoil, and minimize interruptions." For many professional EMS providers, that might really mean, "Push **harder**, push **faster**, allow the chest to fully recoil, and stop only to use a bag mask to ventilate the patient, analyze the rhythm, deliver a shock or intubate. When such an interruption to compressions occurs, keep the length of that interruption to an absolute minimum. For example, take no longer than 10 seconds for any single attempt at intubation.

Providing compressions with minimum interruption should be foremost in the minds of all team members but especially the person who is taking a turn at giving compressions. That team member should very closely track the seconds that elapse whenever compressions are interrupted for any reason. Once five seconds have passed, he or she should warn the other team member(s) and by 10 seconds, compressions should have begun again. This sort of practiced and rigorous routine will reduce the chance that rescuers will fall victim to "adrenaline-rush time-warp effect" and unintentionally prolong the interruptions.

That brings us to compression-ventilation ratios. A ratio of 30:2 has been recommended for all rescuers (lay or health-care provider) who are acting alone in a resuscitation attempt of victims of all ages (except for newly born). You, as an EMS provider, would not likely be acting alone, unless you are off duty. So it is more useful to consider here the recommendations for CPR when performed by more than one professional rescuer. In this case, the recommended ratio

for children and infants differs from adults. Use 15:2 on children and infants and continue to use 30:2 on adults.

Both of these new ratios for compressions to ventilations reflect a very significant jump from the previous Guidelines, and you may be wondering what could have brought on such a dramatic change. The primary factors that drove the ratio up are:

1. Interruptions of compressions for any reason result in a reduction of the total number of compressions delivered in any given unit of time. For example, the old ratios for adults and children would result, under the best of circumstances, in only about 50 compressions being delivered to an adult in a minute and 60 to a child.
2. It takes a number of chest compressions to raise the pressure in the coronary arteries to a level that provides a reasonable amount of blood supply to the heart muscle, itself, and keep it healthy. That pressure drops rapidly with each pause, requiring the first few compressions in the next set to build that pressure back up. So fewer pauses means that more of the total compressions delivered will be effective, rather than being used to build the pressure back up.
3. Recent research has documented that even health-care professionals introduce long and frequent interruptions in chest compressions and that a reduction in the proportion of the time that they spend compressing results in a decrease in the chance that the patient will have a return of spontaneous circulation.
4. A higher ratio reduces the number of ventilations given over time but that

is not as bad as it might seem.

Ventilations are relatively less important during the first minutes of CPR for victims of a sudden arrhythmia-induced cardiac arrest (VF or pulseless ventricular tachycardia) than they are after asphyxia-induced arrest (drowning or respiratory failure due to disease). Even with asphyxial arrest victims, though, their requirement for oxygen is lower than normal. That is true for two reasons. First, the amount of blood that is being pumped by the chest compressions is lower than normal. So the amount of oxygen that can be "picked up" by the blood in the lungs is also a lot lower than normal (no need to provide more breaths than is warranted by the blood flow that is there). Secondly, when cardiac arrest occurs, the body's metabolism really slows; it simply does not use as much oxygen.

5. For lay rescuers, a single compression-ventilation ratio (30:2) for all age groups greatly simplifies the instructions for performing CPR. This should reduce confusion about how to do CPR and increase the level of confidence of potential providers of CPR. Because it is easier to remember the rules, this change may increase the number of bystanders who you encounter performing CPR when you arrive.

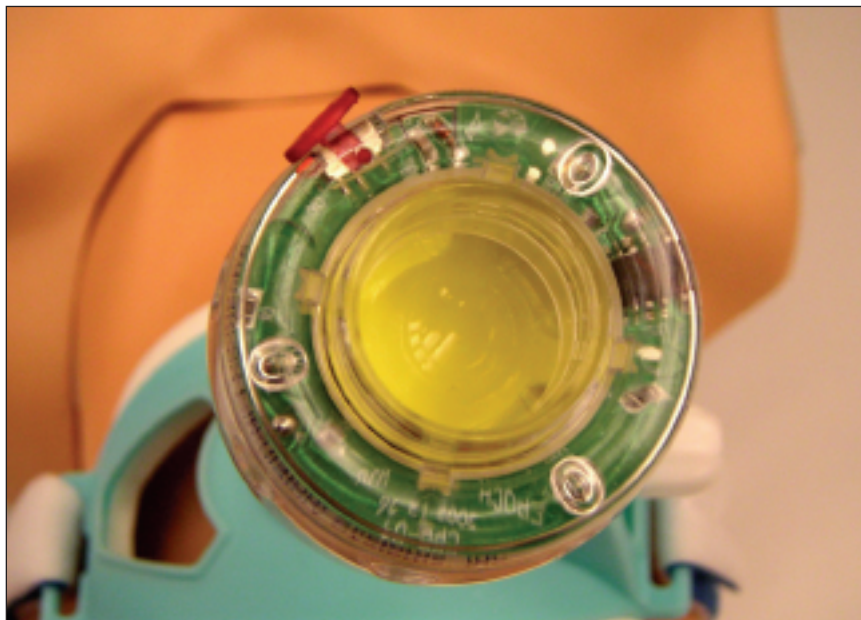
Maintaining adequate compression depth (1.5 to 2 inches for an adult) and rate (100 compressions/minute), and consistently allowing the chest to fully recoil between compressions is very fatiguing. The 2005 Guidelines recommend that health-care professionals swap duty as compressor every two minutes. With the adult patient who has no advanced airway in place, that would be every fifth cycle of 30:2 CPR (see Figure 1, p. 15). For children with no advanced airway in place, that would be about every 10th cycle of 15:2 CPR.

The 2005 Guidelines also provide recom-

recommendations on the use of devices that support or enhance the circulation that is generated during CPR (pp. 46–49). Most of them are related to mechanical compression (like the Michigan Instruments Thumper). The most significant changes in this part of the Guidelines since 2000 are found in the discussions of two devices.

The first is the load-distributing band (LDB). This is a circumferential chest compression device composed of a pneumatically actuated constricting band and backboard. In the 2000 guidelines, the predecessor to this device was discussed as “vest CPR” and its use was given a class IIb recommendation (although no device was commercially available at the time). The class of recommendation for the more recently developed LDB is also a class IIb. This device may be more familiar to you by its proprietary name, the AutoPulse (originally manufactured by Revivant, which is now owned by ZOLL Medical Corp.). Since the conclusion of the evidence-evaluation process for the 2005 Guidelines, reports from two clinical studies of the AutoPulse in the prehospital setting have been presented as abstracts. One of the two studies showed positive results when comparing AutoPulse with standard CPR and the other showed negative results. It is likely that further studies will be conducted to resolve this apparent difference in performance.

The only device for which there was a significant change in the 2005 version of the Guidelines is the impedance threshold device (ITD). Unlike all of the other devices in this section of the Guidelines, the ITD does not operate by compressing the chest. It is used to enhance venous return during chest compressions by lowering the intrathoracic pressure. Also, the ITD is the only device listed in this section that was assigned a class IIa recommendation (upgraded from the class IIb recommendation made in 2000). All of other devices in this section were given a class IIb or class indeterminate recommendation. The ITD may be more familiar to you by its trade name, the ResQPOD (manufactured by Advanced Circulatory Systems Inc.). The 2005 Guidelines state that, “when the ITD is used by trained personnel as an adjunct to CPR in intubated adult cardiac arrest patients, it can improve hemodynamic parameters and ROSC” (return of spontaneous circulation). Some recent research suggests that use of the ITD with a face mask may also create the same negative



**The ResQPOD impedance threshold device** is placed between the ET tube and a ventilation device and lowers the intrathoracic pressure which, in turn, enhances venous return during chest compressions. It also features LED lights that flash in accordance with the new, slower, AHA-recommended ventilation rate.

intratracheal pressure as occurs when the ITD is used with an ET tube, if rescuers can maintain a tight face mask seal (p. 48).

**Ventilations:** The 2005 Guidelines focus on ventilation rate, duration and volume during CPR for a number of fundamental reasons. Perhaps the most important is that less ventilation than normal is needed during CPR. For optimal oxygenation of the blood and elimination of carbon dioxide, ventilation should closely match blood flow through the lungs (the so-called “ventilation-perfusion ratio”). During CPR, blood flow through the lungs is only 25–33% of normal. Thus, significantly less ventilation (fewer breaths and smaller tidal volumes) is required to match the reduced blood flow that chest compressions generate (pp. 23, 27).

Another consideration that drives the current recommendations for ventilation is the recognition that the increased pressure within the chest caused by positive pressure resuscitation breaths reduces venous return to the heart. Because venous return determines cardiac output, reduced venous return means cardiac output is reduced and, thus, delivery of oxygen to tissues in the body is also reduced. An excessive number of ventilations, prolonged ventilation duration or high tidal volumes only increase the amount of time during which venous return is reduced. This can be harmful or even deadly (p. 23).

A third consideration is quite intuitive:

When chest compressions are interrupted, all blood flow ceases. Delivery of ventilations has been shown to be responsible for a significant component of the hands-off time during a resuscitation attempt (the time during which chest compressions are not being performed). Hands-off time approaches 50% of CPR duration in some EMS systems (p. 26). It is unreasonable to expect a successful outcome when forward blood flow is absent during half of a resuscitation. It stands to reason, then, that blood flow should be prioritized over ventilations. The 2005 Guidelines reflect that philosophy.

**Ventilation rate:** Slow down! That is the overriding message for all health-care providers when it comes to ventilation. The tendency to over-ventilate (too many and too much) is not peculiar to prehospital providers, but some startling data that were collected during EMS rescues have demonstrated that there is a significant difference between the way professional rescuers perform CPR in the classroom and the way they deliver CPR on scene at an actual cardiac arrest. Experience has shown that in the heat of the moment, several common mistakes are made during CPR, including ventilating too frequently or delivering breaths with prolonged ventilation duration. Therefore, despite high-quality education and training, additional steps to ensure adherence to guidelines are likely to

be needed (pp. 23, 25).

EMS providers may employ various techniques to better pace their delivery of ventilations. Perhaps the most elegant and cost-effective method is to simply train rescuers to use an existing cue: compressions.

Prior to establishing an advanced airway, simply adhering to the recommended compression-ventilation ratio of 30:2 (adults) or 15:2 (infants and children when two rescuers are working together) reduces the likelihood of excessive ventilation, provided that ventilations are delivered at one second per breath and tidal volume is no greater than that required to produce visible chest rise. It is important to note that hyperventilation has not been reported in every published study. A ventilation rate of 11/minute was reported by one research group who studied prehospital resuscitations.<sup>1</sup> When asked how EMS rescuers were trained to avoid hyperventilation, Wik noted that the rescuers practice compressions and ventilations with manikins on a regular basis to ensure that compression and ventilation rates delivered are accurate.

Following establishment of an advanced airway, compressions and ventilations are no longer delivered in cycles, with pauses in chest compressions to deliver ventilations. The compressing rescuer should deliver compressions at a rate of 100/minute without pauses (except as needed for such actions as rhythm check or shock delivery). The rescuer should deliver no more than eight- to 10-breaths/minute (the recommended rate for adults, children and infants with an advanced airway in place), without attempting to synchronize breaths between compressions. There should be no pause in chest compressions for delivery of ventilations. If chest compressions are delivered continuously at the correct rate of 100 compressions per minute, then that is a reasonable way to gauge the timing of ventilations; deliver a breath no more often than once every 10th compression. This will provide a ventilation rate no greater than 10 breaths per minute.

Devices offer another solution to maintaining an appropriate ventilation rate. End tidal CO<sub>2</sub> waveform monitoring provides another method to assist EMS providers in delivering the correct number of ventilation per minute. Some manufacturers of other EMS equipment, such as defibrillators, are implementing technology that electronically monitors the quality of CPR delivered to a cardiac arrest victim, including ventilation

rate. That technology provides real-time feedback to rescuers and can be used to support quality improvement programs. Another device, the impedance threshold valve, attached to an advanced airway, is demonstrated to improve hemodynamics during CPR and has ventilation timing lights that flash 10 times per minute for one second every flash. The use of this device may not only improve the effectiveness of compressions, but assist rescuers in consistently providing ventilations according to AHA recommendations for breaths per minute with an advanced airway in place.

**Ventilation volume:** Studies in humans with normal perfusion suggest that a tidal volume of 8–10 mL/kg maintains normal oxygenation and elimination of CO<sub>2</sub>. However, during CPR, perfusion is only 25–33% of normal. As a result, lower than normal tidal volume and respiratory rate can maintain effective oxygenation and ventilation during CPR. During adult CPR, that means a tidal volume of approximately 500–600 mL (6 to 7 mL/kg) (p. 23). Because it is not possible to accurately estimate tidal volume, the simplified guidelines for the volume of ventilations provide a single rule to follow for all victims: *Deliver enough air to make the chest rise, and do that over about one second.* This includes rescue breaths delivered both prior to and after establishing an advanced airway. This recommendation is designed to simplify training, reduce the incidence of prolonged ventilation duration (and therefore the time during which there is increased pressure within the chest) and (when no advanced airway is in place) limit the length of the interruption in compressions that is required to deliver ventilations.

**Ventilation devices:** Insertion of an advanced airway may not be a high priority during the initial stages of resuscitation. Rescuers should be aware of the risks and benefits of insertion of an advanced airway. Because insertion of an advanced airway may require interruption of chest compressions for a considerable period of time, the rescuer should weigh the need for compressions against the need for insertion of an advanced airway. Airway insertion may be deferred until several minutes into the attempted resuscitation (p. 52).

Once inserted, providers should immediately perform a thorough assessment of ET tube position. This assessment should not require interruption of chest compressions, and includes physical examination and use

of a device that can reliably indicate incorrect placement. Assessment by physical examination consists of visualizing chest expansion bilaterally and listening over the epigastrium (breath sounds should not be heard) and the lung fields bilaterally (breath sounds should be equal and adequate). If there is doubt about correct tube placement, use the laryngoscope to visualize the tube passing through the vocal cords. Assessment of tracheal tube position may also be confirmed by use of exhaled CO<sub>2</sub> detection or an esophageal detection device. If still in doubt, remove the tube and provide bag-mask ventilation until the tube can be replaced (p. 54).

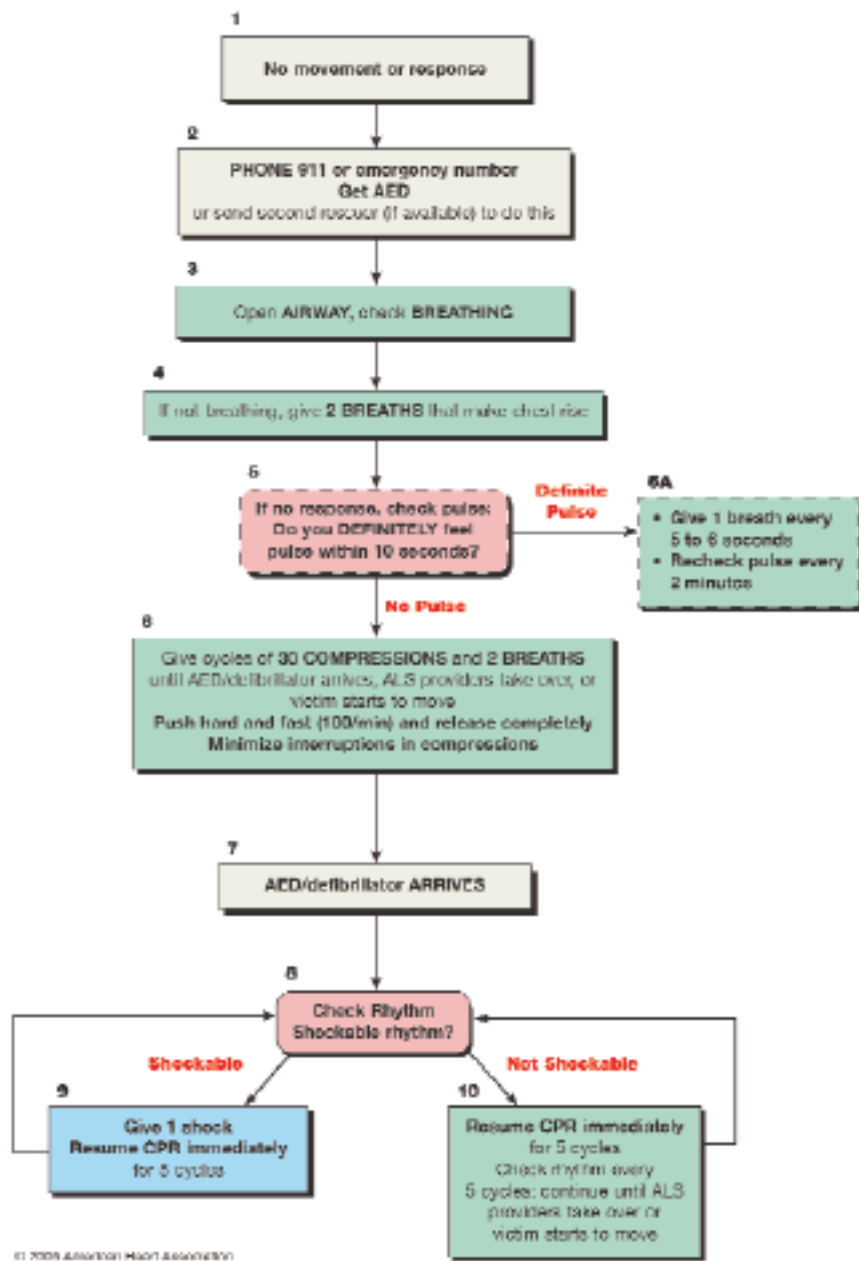
Before an advanced airway is placed (or instead of placing an advanced airway) professional rescuers typically use bag-mask ventilation. It is a challenging skill that requires considerable practice for competency. A tight seal between the bag-mask and the face is best achieved with two rescuers managing the airway. One rescuer opens the airway and seals the mask to the face using a two-handed technique while the other squeezes the bag. Of course, rescuers won't have the luxury of two people to manage ventilation on every call. If only one rescuer is available to manage the airway, a two-handed technique can still be used if the chest compressor squeezes the bag between cycles of chest compressions (pp. 51–52).

Insertion of advanced airway devices, such as the LMA and the esophageal-tracheal CombiTube, is currently within the scope of BLS practice in a number of regions (with specific authorization from medical control). These devices may provide acceptable alternatives to bag-mask devices for health-care providers who are well trained and have sufficient experience to use them. It is not clear that these devices are any more or less complicated to use than a bag-mask device (p. 53).

**Defibrillation:** New recommendations regarding integration of CPR and defibrillation are designed to optimize use of these therapies for any given victim. The two areas that are most dramatically changed for EMS are the use of CPR before defibrillation in some cases (“Shock first vs. CPR first”) and, for all patients, the elimination of “three stacked shocks” in favor of a “one-shock protocol.”

Shock first vs. CPR first—Make no mistake about it, if you witness an arrest, you should check the patient's rhythm and





**Figure 1: Adult BLS Health-Care Provider Algorithm**

(Note: Boxes bordered with dotted lines indicate actions or steps performed by the health-care provider but not the lay rescuer.)

Source: Circulation. 112(24, Supplement): Dec. 13, 2005.

shock, if needed, without delay. That is the treatment of choice for short duration VF. A positive effect of performing some CPR before attempting defibrillation, though, has been observed for out-of-hospital arrests among patients for whom the EMS response times were greater than four to five minutes. In those cases, 1.5 to 3 minutes of CPR before defibrillation improved the chance of a return of spontaneous circulation and the chance of survival. One way to think about why “CPR first” would sometimes be more effective than “defibrillation

first” is captured in a 2002 article by Weisfeldt and Becker.<sup>2</sup> The authors proposed that untreated cardiac arrest patients might pass through three phases over the first few minutes after their arrest: electrical, circulatory and metabolic phases. Each reflects a different physiological state and requires a different action or sequence of actions to optimize the resuscitation attempt. Within about four minutes is thought to be the “electrical” phase of an arrest. The heart is most likely in VF and will most often respond to immediate “elec-

trical” therapy. From four to 10 minutes is referred to as the “circulatory” phase, when VF is “fine” or absent. Some period of effective circulation delivers much needed oxygen to hypoxic tissues and improves the chance of a successful defibrillation. By 10 minutes after an arrest, an accumulation of metabolic byproducts throughout the body make CPR and defibrillation, alone, less likely to be effective. Additional therapies are being studied that may enhance resuscitation efforts for patients in this phase of cardiac arrest.

Backed by some of the same evidence that supports that three-phase model of cardiac arrest (as well as other data), the AHA recommends that you (EMS personnel) may provide two minutes of CPR before checking the rhythm and attempting defibrillation when you encounter an adult victim whose arrest you did not witness. It would be up to the medical director of your EMS system to determine how such a protocol would be implemented. Perhaps use of “CPR first” (or not) would be linked to response time. If, though, the system’s mean response time is much greater than four minutes, it could be that the medical director would decide that all adult patients found in cardiac arrest would receive “CPR first.” Be sure to discuss this one with your system administrators (p. 35).

**One-shock protocol**—The 2005 Guidelines recommend treatment of VF or pulseless VT with delivery of single shocks followed by immediate CPR, beginning with chest compressions. This new recommendation is based on the following evidence derived from clinical evaluation of biphasic defibrillators and from AED recordings:

- Biphasic defibrillators have a high first-shock success.
- Current AEDs require a long period after each shock to analyze the rhythm to determine if subsequent shocks are needed; with current AEDs this requires interruption of chest compressions.
- Perfusing rhythms are not often present immediately after defibrillation (shock elimination of VF); the post-shock myocardium will benefit from CPR.

The guidelines previously (2000 and earlier) recommended provision of up to three “stacked” shocks without intervening CPR for persistent VF. This recommendation was based on the relatively low first-shock efficacy of monophasic defibrillators and their



That explains the elimination of the post-shock rhythm analysis, but why follow the shock with two minutes of CPR if

VF is most likely gone? Most patients do not demonstrate a perfusing rhythm after shock delivery; as noted, VF is not often present. Asystole or pulseless electrical activity are the most common rhythms. In one recent report of 67 victims of VF cardiac arrest, none demonstrated a perfusing rhythm after shock delivery, 16% demonstrated persistent VF, and 84% demonstrated asystole or pulseless electrical activity.<sup>3</sup> Therefore, CPR is needed for several seconds or minutes following successful defibrillation to maintain blood flow to the heart, brain and other organs until a perfusing rhythm returns. If VF is not eliminated by shock delivery, the VF is likely of low amplitude, indicating that the myocardium is deprived of oxygen and nutrients. (The victim is in the “circulatory phase” of cardiac arrest.) CPR (especially chest compressions) can deliver oxygen and nutrients to the myocardium, increasing the VF amplitude and making it more likely to be eliminated by the next shock. Thus, immediate CPR after shock delivery will be beneficial whether VF is present or not.

Rescuers should practice with the defibrillator that they use clinically, and with manikins and fellow rescuers to coordinate shock delivery and CPR to minimize interruptions in chest compressions needed for attempted defibrillation. Ideally, one rescuer provides CPR while the second rescuer retrieves the defibrillator, turns it on and attaches defibrillator pads. The rescuer delivering chest compressions should continue compressions until the AED is ready to analyze the rhythm; if a manual defibrillator is used, the rescuer should perform compressions until the rhythm can be analyzed. Once a shockable rhythm is detected, if a manual defibrillator with adhesive pads is used, the rescuer performing compressions should resume compressions until the manual defibrillator is charged (when practical); then the rescuers should quickly “clear” the victim and deliver a shock, and a rescuer should immediately resume compressions and provide CPR for two minutes.

During cardiac arrest, rescuers should analyze the victim’s rhythm about every two minutes. This will be after about five cycles of CPR for an adult victim with no advanced airway in place. The AHA anticipates that AED manufacturers will facilitate reprogramming of their AEDs to prompt the rescuer and analyze the



PHOTO TOM PAGE

The 2005 AHA Guidelines recommend the **routine use of 12-lead ECG** and advance hospital notification for patients with signs and symptoms of acute coronary syndromes.

rhythm every two minutes.

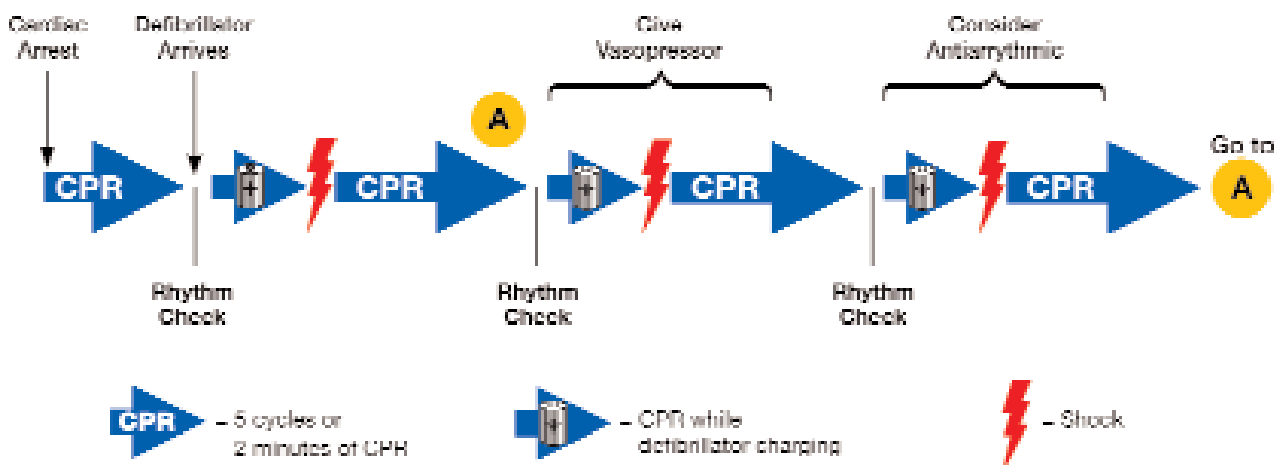
In general, BLS rescuers should continue CPR and use of an AED until the victim starts to move (indicative of a perfusing rhythm) or ALS providers take over. In general, ALS providers should not interrupt chest compressions to check for a pulse unless the provider observes an organized rhythm (regular QRS complexes) on a monitor. Then the provider will check for a pulse. These general recommendations and the one-shock protocol may be modified by a physician in special-

ized settings where continuous (e.g., electrocardiographic or hemodynamic) monitoring is in place.

**Energies:** When an AED is used, the energy provided by the AED is determined by the manufacturer. The one way that rescuers may alter the dose is through the use of a child pad-cable system or a child key or other adjustment that allows the rescuer to reduce the shock dose for use in children ages one to eight years old. If the AED used is capable of such adjustment, the rescuer must be sure to use the system to



## Ventricular Fibrillation/Pulseless VT



**Ventricular Fibrillation/Pulseless Ventricular Tachycardia Sequences:** Prepare next drug prior to rhythm check. Administer drug during CPR, as soon as possible after the rhythm check confirms VF/pulseless VT. Do not delay shock. Continue CPR while drugs are prepared and administered and defibrillator is charging. Ideally, chest compressions should be interrupted only for ventilation (until advanced airway placed), rhythm check and actual shock delivery.

**Figure 3: Ventricular Fibrillation & Pulseless VT—Treatment Sequences for ACLS & PALS**

Source: Currents. 16(4): 2005.

deliver a reduced shock dose only for children under eight years old; if a child system is not available, the rescuer should use a standard AED and adult AED pads. The rescuer should use the “adult” dose (using adult pads or standard AED) for all victims of cardiac arrest who are eight years of age (and approximately 25 kg in weight or about 117 cm in length) and older, and should not use the child system for this age group (p. 39).

Commercially available AEDs provide fixed or escalating energy using either a monophasic or a biphasic (either biphasic truncated exponential or rectilinear biphasic) waveform. Lower-energy biphasic waveform shocks have equivalent or higher success for elimination of VF than monophasic waveform shocks. There has been no direct comparison of biphasic waveforms so no claim of superiority of any biphasic waveform over another, or of non-escalating versus escalating energy biphasic waveform defibrillation is supported by the evidence evaluated in 2005 (pp. 36–37).

If a manual defibrillator is used, the rescuer should be familiar with that defibrillator and with the dose at which that defibrillator waveform has been shown to be effective at elimination of VF. The AHA recommends that defibrillator manufacturers dis-

play the device-specific effective dose range on the front of each device. No single biphasic dose can be recommended because each of the two biphasic waveforms have been shown to be effective in eliminating VF at different selected energies. In general, for a first shock, selected shock energies of 150 J to 200 J with a biphasic truncated exponential waveform or 120 J with a rectilinear biphasic waveform are appropriate. If the rescuer does not know the device-specific effective dose, a default dose of 200 J may be used, but this dose is selected by default because it can be delivered by all AEDs manufactured in 2005—it is not a superior dose. For second and subsequent doses, the rescuer should use a dose equal to or higher than the first dose (pp. 39–40).

**Acute coronary syndromes:** BLS health-care providers are often the first EMS personnel to encounter a patient with a potential acute coronary syndrome or ACS. Commonly known as a “heart attack,” ACS is a group of disorders that share in common the rupture of a lipid-filled plaque in a coronary artery. This begins a series of events that causes clot formation in the artery and interruption of blood flow to the heart muscle. Both BLS and ALS providers play roles in achieving the major goals of therapy for ACS patients defined in the

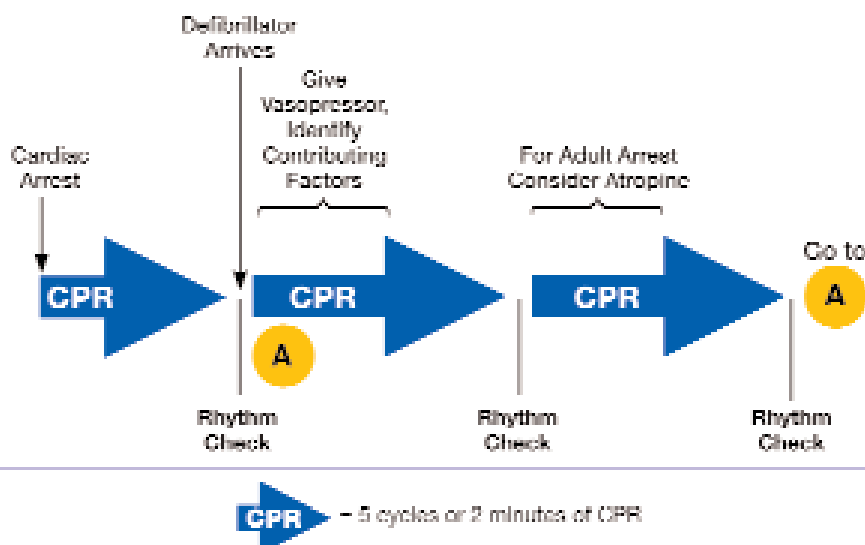
2005 Guidelines. These are:

- Treat acute life-threatening complications, such as VF.
- Reduce heart muscle damage by speeding time to opening of the coronary artery.
- Prevent or reduce major complications of ACS, such as heart failure.

An important first step for BLS health-care providers is the recognition of the symptoms possibly caused by an ACS. Treatment offers the greatest potential benefit, early in the course of ACS, particularly when complete occlusion of an artery has occurred. This involves recognition of possible ACS symptoms, activation of local EMS chest pain protocols (see ACLS and EMS Administrative sections) and advance notification of the receiving facility.

Classically, typical chest discomfort is described as a pressure or tightness in the center of the chest (substernal area) and may be associated with nausea, vomiting, sweating, light-headedness, or near fainting or fainting (syncope). The chest discomfort may radiate to the jaw and one or both shoulders and down the arms (usually left). These typical symptoms are usually recognized by BLS health-care providers. In addition, all providers must also realize that atypical symptoms may be present.

## Asystole and Pulseless Electrical Activity



**ACLS and PALS treatment of Asystole and Pulseless Electrical Activity (PEA) Sequence:** Prepare next drug prior to rhythm check. Administer drug during CPR, as soon as possible after the rhythm check confirms no VF/pulseless VT. Continue CPR while drugs are prepared and administered. Ideally, chest compressions should be interrupted only for ventilation (until advanced airway placed) and rhythm check. Search for and treat possible contributing factors.

**Figure 4: Asystole & Pulseless Electrical Activity—Treatment Sequences for ACLS & PALS**

Source: Currents. 16(4): 2005.

Although chest discomfort is the presenting primary symptom in both men and women, women have more atypical symptoms than men. Atypical symptoms may also predominate in the elderly and diabetics. The sudden onset of unexplained shortness of breath, weakness or fatigue are examples of atypical symptoms.

Once a potential ACS is recognized, BLS providers can speed the diagnosis and initiate treatment of the possible ACS patient in the following ways (pp. 97–98):

- Administer oxygen to all patients with suspected ACS. Initiate supplementary oxygen at 4 L/min by nasal cannula; titrate to achieve oxygen saturation  $\geq 90\%$ .
- If the patient has not taken full-dose aspirin, have the patient chew 160–325 mg non-enteric aspirin, unless true allergy or recent gastrointestinal bleeding has occurred.
- If the patient has been prescribed sublingual nitroglycerin, give (or complete giving) as many as three nitroglycerin doses (tablet or spray) if blood pressure and heart rate permit.
- Half of the patients who die suddenly from ACS do so before they reach a hospital. Although a VF/VT arrest is uncommon during transport, be pre-

pared to use an AED or defibrillator.

Once ALS personnel arrive, assist providers in completing appropriate pre-hospital care (see below).

**Stroke:** In the realm of stroke care, the new guidelines emphasize the importance of stroke patient recognition, priority dispatch and rapid transport to an appropriate health-care facility capable of caring for stroke patients. Although most of the critical actions to be provided by EMS personnel have not been changed, the need for efficient assessments and early communication with destination hospitals is also underscored.

Regardless of the level of prehospital care provided, triage policies should be proactively established in order to guide EMS personnel's transport decisions. Such triage policies will likely require input from EMS medical directors, physicians, hospital administrators and any other stakeholders in stroke care (pp. 111–112). The new guidelines also recommend that consideration be given to transporting a witness, family member or caregiver who can provide time-sensitive information related to the patient's events, thus expediting the patient's care in the emergency department.

With regard to stroke recognition, the

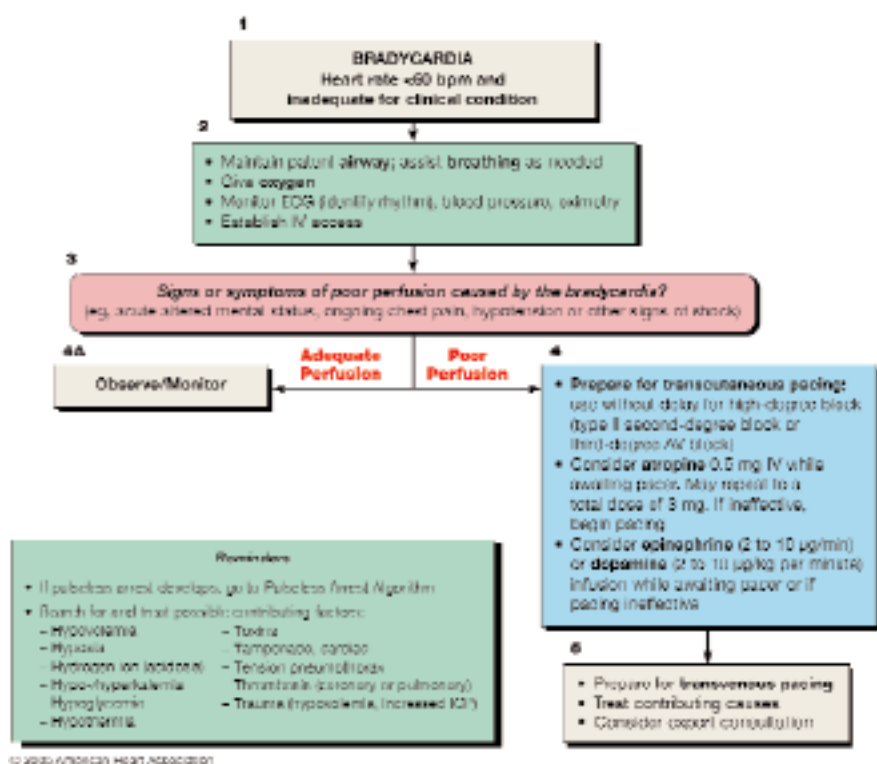
new guidelines stress the importance of EMS personnel knowledge of the signs and symptoms of stroke. Further, if stroke is suspected, all EMS personnel should be competent in the utilization of a prehospital stroke assessment tool (see Table 1, p. 27).

Finally, the new recommendations highlight the need for identifying the time of onset of the patient's symptoms. If possible, EMS personnel should also attempt to identify the last time the patient was known to be acting normally. This time does not always correspond with the identified time of symptom onset, but it has important implications with regard to available medical therapies.

## ADVANCED CARDIAC LIFE SUPPORT

**Pulseless arrest algorithm (VF/pulseless VT; asystole/PEA):** Individual algorithms for ventricular fibrillation, pulseless VT, asystole and PEA are now combined into one algorithm—The Pulseless Arrest Algorithm (see Figure 2, p. 16). This combination was designed to simplify clinical application and to emphasize the key role of high-quality CPR as an essential component in all pulseless arrest resuscitations.

The most critical interventions during the first minutes of a VF/pulseless VT arrest



**Figure 5: Bradycardia Algorithm**

Source: Circulation. 112(24, Supplement): Dec. 13, 2005.

are immediate bystander CPR and defibrillation. In cases of a witnessed arrest with a defibrillator on site, it should be applied and used after you give two breaths and determine that a pulse is absent. New is the one-shock protocol, discussed above (see Figure 3, p. 18). If VF/pulseless VT persists, give a vasopressor. Epinephrine 1.0 mg is still recommended at three- to five-minute intervals. Vasopressin 40U IV/IO can be substituted for the first or second dose of epinephrine. If adequate personnel are available, they need to anticipate the administration of a vasopressor or an antiarrhythmia agent. Prepare the drug in advance and administer it *without* interrupting chest compressions. When VF/pulseless VT persists despite shocks and a vasopressor, consider an antiarrhythmic agent. Amiodarone is preferred but lidocaine may be used if amiodarone is not available.

Asystole and PEA are ominous rhythms with a poor survival rate. Because of the similarity in management, they are combined in the pulseless arrest algorithm. Again, high-quality CPR and effective chest compressions are key to survival and interventions are organized around the two-minute periods of CPR (see Figure 4, p. 19). The 2005 Guidelines emphasize early iden-

tification of a reversible cause, if possible, and an attempt at correction, as a bridge to a perfusing rhythm and definitive care. Administration of a vasopressor (either epinephrine or vasopressin) and atropine (for patients in asystole or slow PEA) is unchanged.

**Management of symptomatic bradycardia & tachycardia:** The tachycardia algorithms are simplified and incorporated into a single algorithm, Tachycardia with Pulses (see Figure 6, p. 22). Both the Tachycardia with Pulses algorithm and the Bradycardia algorithm (see Figure 5, above) differentiate treatment based on the presence of symptoms due to the rhythm abnormality.

If the patient has a tachycardia with a pulse but is *persistently symptomatic* (usually with a heart rate  $\geq 150$  beats per minute) perform immediate synchronized cardioversion. Symptomatic or unstable signs include altered mental status, ongoing chest pain, hypotension or other signs of shock. An IV may be established and sedation given if that will not delay the delivery of synchronized cardioversion. If the patient is stable, establish IV access and obtain a 12-lead ECG. Determine if the QRS is narrow ( $< 0.12$  seconds) or wide ( $\geq 0.12$  seconds).

If a **narrow regular QRS** complex is present, attempt vagal maneuvers. If vagal maneuvers fail and EMS protocols authorize, give adenosine, 6 mg rapid IV push. If no conversion, 12 mg rapid IV push may be given and repeated once. That is unchanged from the 2000 Guidelines recommendations. For EMS providers, additional management is simplified. If conversion with vagal maneuvers fails or a **regular or irregular wide QRS complex** is present *seek expert consultation*. Be prepared to defibrillate or perform synchronized cardioversion if the patient or rhythm becomes unstable.

**ALS ACS management:** ALS providers may need to begin or complete the initial assessment and management of a patient with potential ACS (see BLS section above). Initial EMS care includes the administration of oxygen, aspirin and nitrates. If three doses of nitroglycerin have not completely relieved chest discomfort, ALS personnel should consider administration of morphine sulfate, if protocols permit (pp. 97–98).

ST-segment elevation myocardial infarction, or STEMI, is usually due to a complete occlusion of a major coronary artery on the surface of the heart. Heart muscle begins to die at about 15–20 minutes after interruption of blood supply. Additional ACLS interventions, then, are directed toward a goal that permits rapid opening of this infarct related artery (IRA). Reestablishment of flow (reperfusion) is critical in reducing death, decreasing heart failure and the complications of myocardial infarction. EMS interventions shown to improve the likelihood of achieving early reperfusion are (pp. 89–91):

- Out-of-hospital 12-lead-ECGs.
- Prior notification of the receiving facility.
- Transport of the patient to an appropriate facility.

Performance of a 12-lead ECG, completion of a fibrinolytic checklist—when appropriate—and advance notification of the receiving facility can speed the diagnosis and shorten the time to reperfusion, and may be associated with reduced infarction and mortality. For these reasons, the 2005 Guidelines recommend that qualified and specially trained paramedics and pre-hospital nurses in urban and suburban EMS systems complete these procedures for patients with a potential ACS (p. 91).

In general, diversion to hospitals with specific reperfusion capabilities should be guided by local EMS protocols and is dis-



cussed in the EMS administrators section. When such protocols are in place, a special situation applies to patients in cardiogenic shock or with large myocardial infarction and heart failure (impending shock). Signs of significant heart impairment that should be recognized by EMS personnel are: 1) shock (usually defined as a systolic BP < 80 mmHg), 2) heart rate > 100 bpm and blood pressure < 100 mmHg, and 3) pulmonary congestion (rales).

If any one or more of these signs are present, patients are at the highest risk for death and complications of STEMI. These patients benefit from direct percutaneous coronary intervention (PCI), for example, initial angioplasty/stent or surgical revascularization. When possible, such patients should be taken directly to an interventional facility. Also, patients who are not eligible for fibrinolytic therapy (see Figure 7, p. 23) should be taken to a PCI facility when possible. Otherwise, a transfer will be required. Recommendations related to that transfer are discussed in the EMS administrators section (p. 92).

**ALS stroke management:** The new stroke guidelines for ALS providers are largely the same as those described for the BLS provider. Triage policies should be established that reflect the agreement of regional stakeholders on stroke care. Competence in the use of a prehospital stroke assessment tool remains a top priority as is an appreciation for the importance of identifying the last time a patient was known to be acting normally. In addition to the BLS level of care, ALS personnel should always perform serum blood glucose measurements in accordance with their protocols. The need to identify hypoglycemic patients manifesting abnormal neurologic function/behavior cannot be understated. Lastly, as with BLS, prehospital notification to the receiving hospital will allow medical resources to be prepared and mobilized promptly upon patient arrival (pp. 111–115).

## PEDIATRIC PATIENTS

**Compression-ventilation ratio** (see Figure 8, p. 24): To simplify education and improve retention of the steps of CPR, a universal 30:2 compression:ventilation ratio is recommended for all single rescuers (lay and health-care providers) and for all victims (except newborns). In infants and children, however, the etiology of cardiac arrest is more often secondary to hypoxia, hypercapnia or both



PHOTO KEVIN LINK

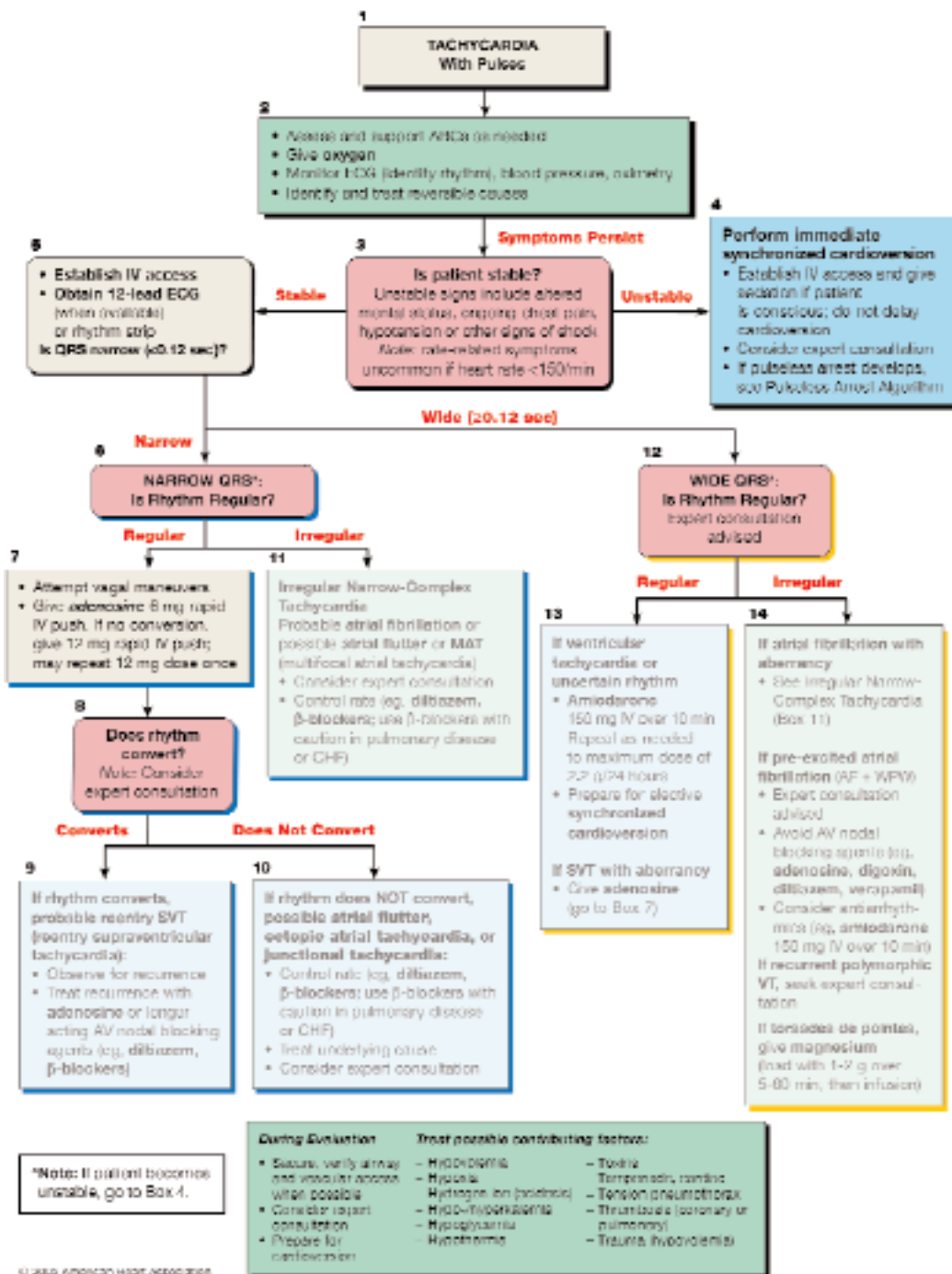
Stroke patients who require hospitalization should be admitted to a facility with **a dedicated stroke unit** (staffed by a multidisciplinary team experienced in managing stroke) when one is available within a reasonable transport interval.

(called asphyxial arrest) rather than sudden cardiac arrest from VF or pulseless VT. Thus, the use of a 30:2 compression:ventilation ratio may not provide adequate ventilation to correct hypercarbia and hypoxemia. Therefore, a compression:ventilation ratio of 15:2 is recommended when two or more health-care providers are performing CPR together, which is the most likely scenario for EMS personnel. To simplify education and improve retention for lay rescuers, they are taught neither two-rescuer CPR nor the 15:2 ratio for children and infants (see the lay provider section, below) (pp. 160–161).

Note that two-rescuer CPR is continued for approximately two minutes (about 10 cycles of 15:2 CPR) in infants and children prior to defibrillation for unwitnessed out-of-hospital, the most likely scenario that would be encountered by EMS personnel.

Chest compressions for children (age 1 to puberty) may be performed with either one or two hands, depending on the size of the patient and the strength of the rescuer, with the hands centered on a line drawn between the patient's nipples (intermammary line). Since it is important to achieve effective chest compression and since fatigue is more likely to occur with the use of only one arm, it is acceptable to use two hands provided that the health-care provider does not apply too much force (compression depth should be one-third to one-half the depth of the chest) and does not compress over the xiphoid or on the ribs (pp. 160–161).

Chest compression in infants can be performed using two fingers, placed just below the intermammary line, rather than centered over the intermammary line. When two health-care providers are working



**Figure 6: Tachycardia Algorithm**

Source: Circulation. 112(24, Supplement): Dec. 13, 2005.

together, though, chest compressions can be provided to an infant using the two thumb-encircling hands technique. As noted above, there is new attention to application of a thoracic squeeze with the fingers in addition to sternal compression with the thumbs (pp. 160–161).

**Airway & ventilation:** If cervical trauma is not suspected, a head tilt-chin lift is recommended to open the airway. If the mechanism of injury suggests the presence

of cervical injury, the airway should be opened with a jaw thrust. If the latter is not effective, then head tilt-chin lift may be applied. Move the head only as far as is needed to open the airway (pp. 157–158).

Note that providers are encouraged to make a few attempts to open the airway in children and infants, as opposed to the instructions for adults that place less emphasis on ensuring effective ventilation with each rescue breath (see CPR section, above). The

recommendations reflect the relatively greater incidence of hypoxic arrest among infants and children (pp. 158–159).

In the pediatric patient with a perfusing rhythm who requires ventilation, provide rescue breaths at 12–20 breaths/min (one breath every three to five seconds), using the higher end of that range for infants and small children. Again, breaths should be delivered over one second and the tidal volume that is delivered should be sufficient to

just cause chest rise. The mnemonic, “squeeze-release-release” stated slowly using one second per word may be helpful to deliver about 20 breaths/minute (p. 159).

For short transport times, bag-mask ventilation is preferred over attempts at endotracheal intubation for most EMS providers. In select situations, such as when transport time is long, endotracheal intubation may be used by trained health-care providers. It is highly recommended that these providers participate in ongoing quality control to ensure that endotracheal intubation is performed safely (pp. 168–169).

Following endotracheal intubation, tube position is confirmed by clinical examination, as previously detailed, combined with detection of exhaled CO<sub>2</sub>, recognizing that cardiac arrest victims may not have sufficient exhaled CO<sub>2</sub> to be detected. When tube position is uncertain, it should be confirmed by direct visualization of the tube passing through the glottic opening. An esophageal detector device is an acceptable alternative for children > 20 kg who have a perfusing rhythm; there is no objective data on the use of this device in cardiac

arrest victims (p. 169).  
If the health-care provider is properly trained, an LMA may be used in place of endotracheal intubation. Similarly, a pharyngeal-tracheal CombiTube may be used in children > 35 kg (p. 167).

As in adults, once an advanced airway is inserted in children, chest compressions are delivered continuously at a rate of 100/minute while ventilations are given at a rate of eight to 10 breaths/minute (one breath every six to eight seconds) *without pausing chest compressions* (p. 159).

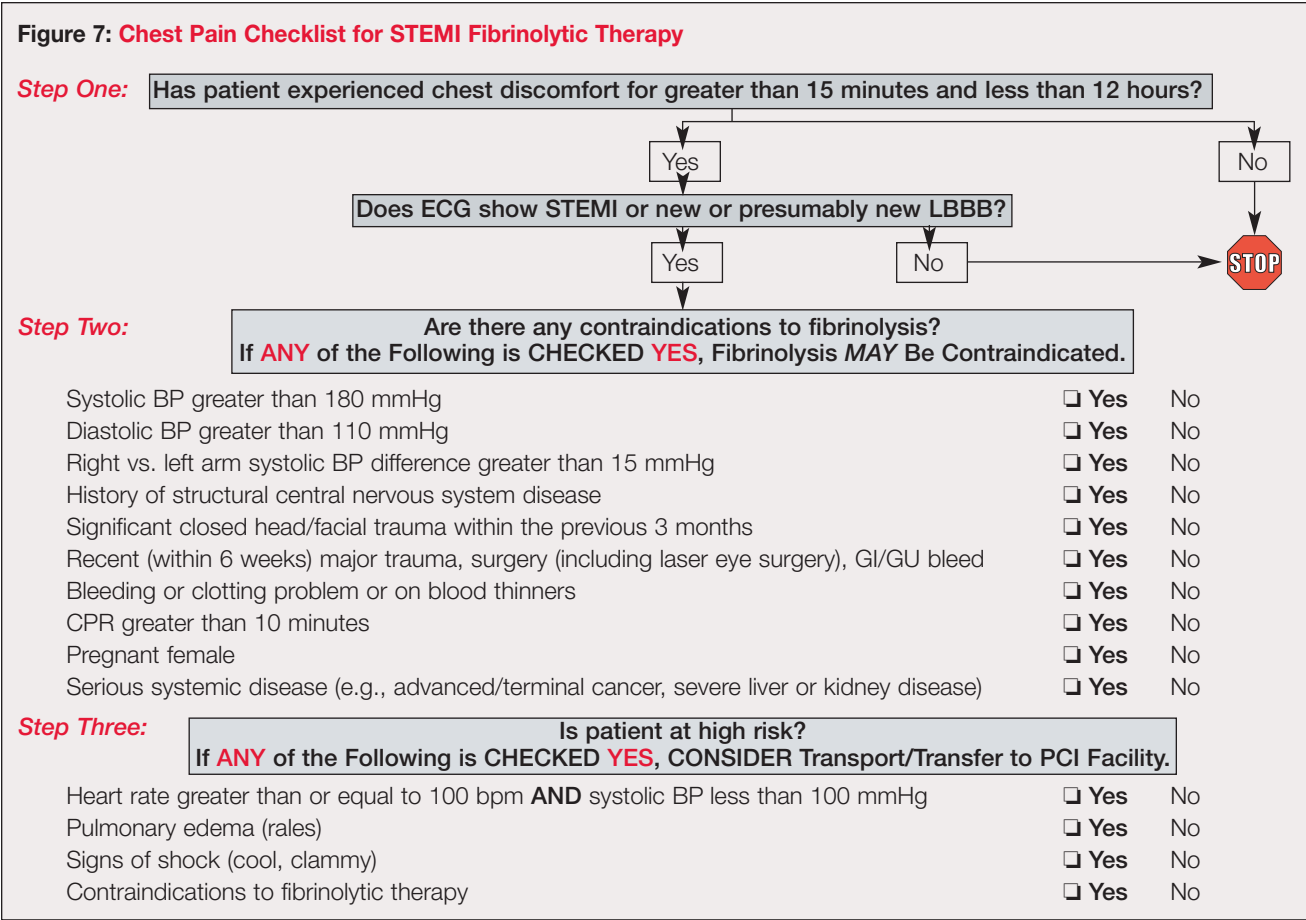
Because pediatric cardiac arrests are most commonly due to respiratory disorders, a higher than expected airway pressure is sometimes needed to achieve chest rise. For this reason, it is often more effective for two or more rescuers to focus on delivering the rescue breaths: one rescuer opens the airway and seals the mask to the face while a second rescuer compresses the ventilation bag. If a third rescuer is available, he or she should apply cricoid pressure to reduce the risk of gastric distension (p. 168).

If permitted by your EMS agency, pas-

sage of an oro- or nasogastric tube is often helpful after endotracheal intubation to relieve gastric distension that often complicates bag-mask or mouth-to-mouth ventilation. Relief of gastric distension often significantly improves the effectiveness of ventilation (p. 168).

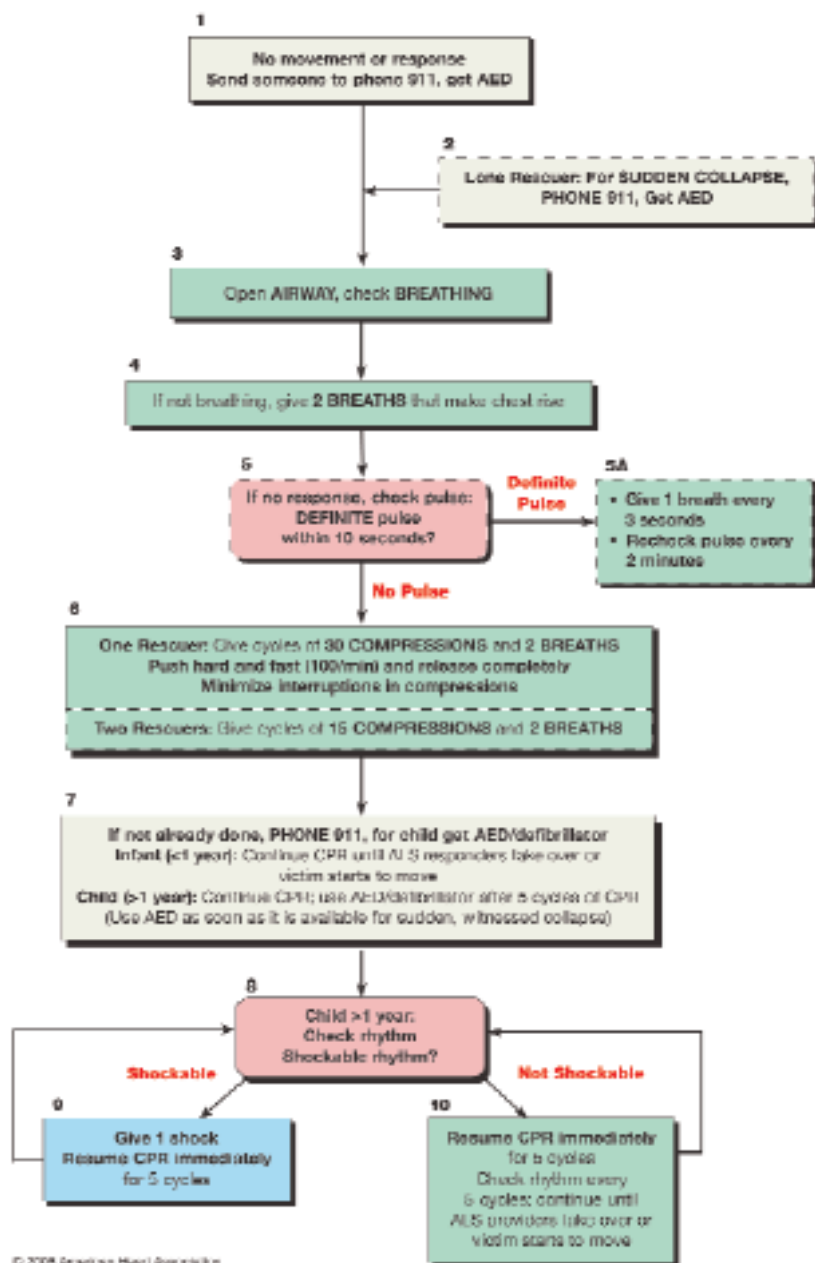
**Drugs & drug administration** (see Figure 9, p. 26): In children who do not respond to effective ventilation and chest compression, administration of epinephrine is recommended. Vascular access is often difficult to achieve in children, so early insertion of an intraosseous (IO) needle is recommended and may be used in any age child (p. 170) If vascular access cannot be rapidly achieved, epinephrine may be administered by the endotracheal route using a high dose (0.1 mg/kg) since standard doses given by this route may cause peripheral vasodilation, reducing coronary perfusion pressure (pp. 170, 172).

High-dose epinephrine is no longer routinely recommended in children who fail to have ROSC with standard doses, because data show that it does not improve survival and indeed may have an



Adapted from: Circulation. 112(24, Supplement):IV-92, Dec. 13, 2005.





**Figure 8: Pediatric Health-Care Provider BLS Algorithm** (Note: The boxes bordered by dotted lines are performed by health-care providers and not by lay rescuers.)  
Source: Circulation. 112(24, Supplement): Dec. 13, 2005.

adverse effect on patient outcome.<sup>4</sup> In the child who fails to have ROSC, emphasis should be placed on ensuring that high-quality chest compressions are delivered with minimal interruptions and that excessive ventilation is avoided.

Although data are lacking comparing amiodarone with lidocaine in children with life-threatening ventricular arrhythmias, based on adult data, amiodarone is considered the drug of choice in children. Lidocaine is an acceptable alternative when amiodarone is not available (pp. 171–172).

## EMS DISPATCHERS & SYSTEM ADMINISTRATORS

EMS dispatcher training and protocols: The 2005 Guidelines emphasize the integral role of the EMS dispatcher. One of the most valuable functions of the EMS dispatcher with respect to emergency cardiovascular care is the provision of prearrival instructions. EMS dispatchers have proven successful in this task for many years. Simply providing telephone CPR instructions has proven to increase the likelihood of bystander CPR being performed. Currently available medical dispatch programs have

recently been updated to accommodate differences in CPR instructions based on the etiology of the arrest. In specific cases (e.g., poisoning, severe trauma, drowning), ventilation should have a higher priority than it might in cases of witnessed sudden cardiac arrest. Also key in determining appropriate prearrival instructions is the differentiation between normal breathing and agonal gasps. The presence of agonal gasps may cause the caller to believe the victim is breathing effectively. Dispatchers should ask if the victim is “breathing normally.” If the caller is unsure whether the victim is breathing normally (or breathing at all), dispatchers should assume that there is no normal breathing present in the adult cardiac arrest victim. Remember, there is far less potential to do harm from advising the caller to perform CPR when it’s not really necessary than there is from advising the caller not to do CPR when, in fact, it is needed by the victim (p. 20).

Medical dispatch programs should be updated to ensure that the 2005 Guidelines are reflected in dispatchers’ questions. System administrators responsible for updating medical dispatch programs must critically evaluate their existing programs and provide retraining, as needed.

The 2005 Guidelines address one additional and often overlooked component—quality improvement (QI). EMS dispatch administrators should implement a QI program that evaluates, retrospectively, the actual use of the dispatcher scripts and whether the questions asked led to the most appropriate instructions (p. 29).

**CPR first:** The 2005 Guidelines reaffirm the value of early, high-quality CPR. Perhaps just as important to the EMS provider are the recommendations related to the integration of CPR with defibrillation: “one-shock protocol” and “CPR first” (for unwitnessed arrest), both discussed above. Of the two recommendations, implementation of the latter could be more complex, particularly if it is linked to the length of the response time (9-1-1 call-to-arrival interval). With that approach, responders would need to be aware of their response time to know whether they should provide CPR for two minutes before attempting defibrillation or for only as long as it takes to get the defibrillator ready. On the other hand, a medical director may wish to implement CPR-first as the default action for all adult victims who are in arrest prior to EMS arrival. This is the case in several U.S. met-

ropolitan areas today. That is why this CPR-first protocol was worded in a “permissive” way for EMS personnel (“may give ...”) rather than in a prescriptive way (“should give ...”) and is recommended for consideration by EMS administrators.

If an EMS system decides to adopt a CPR-first protocol, changes in written protocols and training are required. If the practice is contingent upon response time, a mechanism for tracking that will also be required (portable radios would make this pretty easy to accomplish). Appropriate protocols and training scenarios should be created so that trainees learn to assess the victim and immediately begin CPR, even though a defibrillator is present (unless protocols for known, short response times are also implemented). The scenarios used in this training must illustrate that CPR should continue for at least two minutes prior to rhythm assessment and shock (“CPR first”). Instructors should also utilize scenarios that illustrate performing CPR for only as long as it takes for a second rescuer to prepare for rhythm assessment and shock (“*immediate* defibrillation”) when the responder *witnesses* the cardiac arrest (or if a protocol for known, short response times is also implemented).

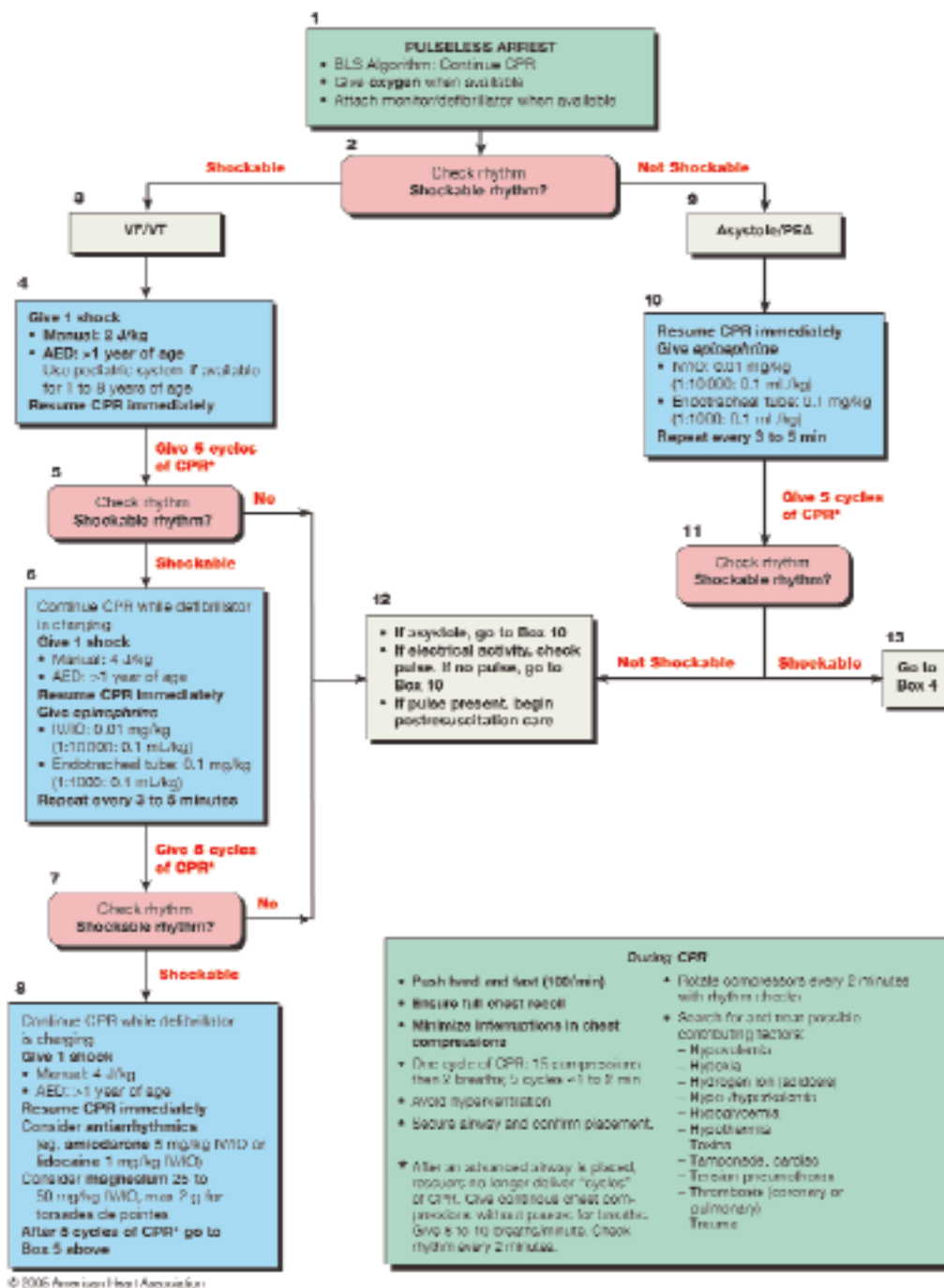
**Prehospital ECG:** The 2005 Guidelines reaffirmed the importance of early identification and treatment of ACS, particularly STEMI. In fact, implementation of prehospital 12-lead ECG diagnostic programs in urban and suburban EMS systems was assigned the highest class of recommendation. This presents no small challenge for many EMS administrators. The technology and training to acquire, transmit and/or interpret the 12-lead ECG simply does not exist in many systems. It is, however, an appropriate goal for EMS systems in all settings and has been shown to introduce a minimal increase (0.2 to 5.6 minutes) in the on-scene time interval. The potential benefits of prehospital ECG interpretation are clear. Studies have shown that the reduction in the time required to deliver reperfusion therapy to the patients after arrival at the hospital (the door-to-reperfusion interval) can range from 10–60 minutes when prehospital ECG programs are in place (p. 91).

To achieve the greatest effectiveness, EMS responders must be trained to integrate ECG evaluation of every suspected ACS patient into the patient’s overall care (as described in a previous section). Once



PHOTO TOM PAGE

**Crews must continue chest compressions** while their defibrillator is charging and immediately resume compressions after a shock without a pulse or rhythm check for five cycles of CPR (about two minutes) before assessing the rhythm again.



**Figure 9: PALS Pulseless Arrest Algorithm**

Source: Circulation. 112(24, Supplement): Dec. 13, 2005.

the 12-lead ECG is acquired, the EMS responder should either communicate the ECG interpretation (if trained to do so) or transmit the ECG to the receiving facility for interpretation. Receiving hospitals should, in turn, use the 12-lead ECG interpretation to prepare for the suspected ACS patient. If EMS providers identify STEMI on the ECG, it is reasonable for them to initiate a fibrinolytic checklist (p. 91).

EMS systems that routinely acquire and

transmit and/or interpret the 12-lead ECG should implement a continuous QI program aimed at reducing the overall time to reperfusion. Accurate ECG interpretation and early notification of the receiving facilities should be the focus of such efforts. For systems that already have 12-lead ECG acquisition capability, the impact of this guideline is limited to a focus on quality improvement efforts.

#### Out-of-hospital administration of

**fibrinolytics:** As discussed previously, early 12-lead ECG acquisition and interpretation remains a primary focus of prehospital care for suspected ACS. Some EMS systems may, however, choose to also implement out-of-hospital delivery of fibrinolytic agents. While the 2005 Guidelines affirm the safety and feasibility of this intervention, EMS systems must be prepared for the additional challenges posed by prehospital administration of fibrinolytics to the STEMI patient.



One critical challenge for the paramedic administering fibrinolytics in the out-of-hospital setting is performing an effective assessment for contraindications to fibrinolysis. The EMS system, particularly the EMS medical director, must develop a process for fibrinolytic administration that is focused on identifying the *right* patient, at the *right* time and under the *right* circumstances. A checklist used to determine the eligibility of the patient and a checklist to guide the administration procedure can minimize error and improve patient safety.

Another critical element of such a process is paramedic skill in the rapid acquisition of a quality 12-lead ECG and the rapid, accurate interpretation of the 12-lead ECG. Electronic transmission of the 12-lead ECG to a qualified physician serves as an effective consulting resource to the paramedic. The ability to communicate (voice and ECG data) with the receiving facility remains another critical element for those EMS systems administering fibrinolytics.

Even more important to the success of an out-of-hospital fibrinolysis program is the active involvement of a medical director experienced in the management of STEMI patients. The medical director must work to ensure safety and efficacy of this program by regularly measuring the effectiveness of the program and implementing improvements as needed. It is worth repeating that the Guidelines place more emphasis on the importance of EMS systems focusing on 12-lead ECG acquisition, transmission and/or interpretation along with early notification of the receiving facility than on providing prehospital fibrinolytic therapy (p. 91).

**Out-of-hospital triage of suspected or confirmed STEMI:** For several years, EMS systems have grappled with the issue of transport protocols for suspected or confirmed STEMI patients. Inadequate evidence was available to make specific recommendations about triage and bypass of patients directly to a PCI capable facility based on the available evidence. In addition, the Guidelines could not effectively address all of the EMS system issues associated with triage and bypass. Therefore, the EMS system and its medical director must take responsibility for program design at the local level. In doing so, transport time, system resources, the availability of PCI-capable facilities along with local hospital medical management capabilities must be considered, keeping in mind that “bypass” orders will have an impact on hospital sys-

tem resource allocation, particularly in the rural EMS setting.

In addition, when STEMI patients with contraindications to fibrinolytic therapy arrive at a facility that cannot perform PCI, transfer to another facility will be necessary. The 2005 Guidelines concur with the ACC/AHA 2004 STEMI Guidelines by recommending that patients who require such inter-facility transfer depart from the initial hospital within 30 minutes after their arrival (door-to-departure time of 30 minutes). This will require coordination and integration of ED and EMS system protocols (p. 92).

**Direct transport to a dedicated stroke unit:** There is strong evidence to support improved outcomes of stroke patients who are managed in stroke units. The benefit of stroke units appears to stem from the coordinated, multidisciplinary care that these units offer. As a consequence, the new guidelines instruct EMS personnel to consider triaging stroke patients to hospitals that can provide this level of care. Recognizing that unique geographic, time, distance and resource variables complicate triage decisions by EMS personnel, the need for proactively developed triage guidelines is self-evident. It is critical that all stakeholders in stroke care be involved in this process so that the final policy can provide clear direction for EMS personnel at the time of patient care (pp. 113–115).

**Improving response intervals:** EMS systems throughout the U.S. have long grappled with the issue of improving response times. In urban settings, increasing populations, traffic congestion and victim access com-

pound the problem of shortening response intervals. In contrast, rural EMS systems are faced with sparse populations, fewer response units, longer hospital transport times and fewer trained and available responders. While adding response vehicles often seems to address the issue, increasingly limited financial resources are making this approach less desirable. Shortening the EMS response interval (call to arrival time) is important, but the greatest impact on survival is realized when the response interval is reduced to less than five to six minutes. EMS systems should use a QI program to evaluate the effectiveness of their response to cardiac arrest victims. Measuring the rate of survival to hospital discharge for VF sudden cardiac arrest should be used to determine the effectiveness of any system changes (pp. 16, 19).

The 2005 Guidelines clearly emphasize the importance of providing immediate, high-quality CPR with minimum interruptions and early defibrillation. EMS system administrators should consider how well these two therapies (high-quality CPR and effective defibrillation) are provided to victims of sudden cardiac arrest. Administrators should not overlook or underestimate the value of fostering strong community involvement in their efforts to improve survival to hospital discharge. Community CPR training and AED programs, strongly tied to the EMS system, are a key element of a community’s response system and may provide an economically reasonable approach to augmenting EMS responses to cardiac arrest in settings where response times are not optimal (pp. 12, 35, 37–38).

**Table 1: The Cincinnati Prehospital Stroke Scale**

**Facial Droop (have patient show teeth or smile):**

- ☐ Normal—both sides of face move equally
- ☐ Abnormal—one side of face does not move as well as the other side

**Arm Drift (patient closes eyes and holds both arms straight out for 10 seconds):**

- ☐ Normal—both arms move the same or both arms do not move at all (other findings, such as pronator drift, may be helpful)
- ☐ Abnormal—one arm does not move or one arm drifts down compared with the other

**Abnormal Speech (have the patient say, “You can’t teach an old dog new tricks.”):**

- ☐ Normal—patient uses correct words with no slurring
- ☐ Abnormal—patient slurs words, uses the wrong words or is unable to speak

**Interpretation:**

If any one of these three signs is abnormal, the probability of a stroke is 72%.

*Adapted from: Circulation. 112(24, Supplement):IV-113, Dec. 13, 2005.*

**Improving CPR:** The hemodynamics generated by CPR and the resulting outcome are dependent on the quality of CPR delivered to a victim of cardiac arrest. EMS systems should focus on methods to improve the quality of CPR provided by health-care providers. These may include education, training, assistance or feedback from biomedical devices, mechanical CPR and electronic monitoring. Components of CPR known to affect hemodynamics include ventilation rate and duration; compression depth, rate, and number; achieving complete chest recoil; and limiting hands-off time. Systems that deliver professional CPR should implement processes of continuous QI that include monitoring the quality of CPR delivered on scene at a cardiac arrest, other process-of-care measures (e.g., initial rhythm, bystander CPR and response intervals) and patient outcome to hospital discharge. This evidence should be used to maximize the quality of CPR delivered. The American Heart Association and the International Liaison Committee on Resuscitation have published recommended data elements that should be acquired as part of a comprehensive QI program.<sup>5</sup>

Those same elements have been integrated into the National Emergency Medical Services Information System (NEMSIS) dataset. Any patient care record system that is NEMSIS compliant will provide an adequate complement of EMS data.

### LAY PROVIDERS

One goal of the 2005 Guidelines is to further simplify CPR and first aid for lay providers, thus, increasing the chance that you'll find someone aiding a victim when you arrive on scene. The 2005 Guidelines for lay providers are different in the following ways.

**Assessment of the need for CPR:** Lay rescuers are no longer told to look for signs of circulation after giving two rescue breaths. Once the lay rescuer has determined that the victim is not breathing normally and two rescue breaths have been delivered, he or she will immediately begin chest compressions. This change is based on the idea that the subsequent assessment for signs of life was largely based on a reassessment of breathing (as well as looking for coughing or movement). This added step was, then, redundant with the initial assessment of breathing. Eliminating the

signs of life assessment for lay rescuers reduces the delay before delivery of chest compressions to people who are in cardiac arrest and it eliminates a decision point that could lead to a lay rescuer deciding not to deliver chest compressions to someone who, in fact, needs them (pp. 13–14).

The implication for you is that there will be less likelihood of finding a bystander delivering just rescue breaths. It's "all or nothing." Lay provider courses based on the 2005 Guidelines will teach rescue breaths with compressions, but not rescue breathing, alone.

**Compressions:** Lay rescuers are instructed to perform CPR using a 30:2 compression:ventilation ratio on all victims. Unlike health-care providers, they are not taught to perform two-person CPR and, therefore, are not taught to use the 15:2 ratio for children and infants. The target compression rate taught to lay providers does not differ from your own training: 100/minute.

**AED protocols:** Lay rescuers, like health-care professionals, will be taught to provide two minutes of CPR immediately after each shock from a defibrillator (an AED, in the case of lay rescuers and basic



PHOTOS JONNY LAVERSKY

**When two or more health-care providers** are present during CPR, rescuers should administer medications without interrupting compressions. They should also rotate the compressor role every two minutes (see opposite).

EMTs). That means that, unless a victim begins breathing spontaneously (or begins to breath normally and move voluntarily) at any time during the resuscitation attempt, lay rescuers will continue with cycles of analysis, shock (if advised) and two minutes of CPR until an ALS team arrives. So even if an automatic rhythm analysis by the AED says that there is “no shock advised,” the lay rescuer will continue with CPR and allow the AED to reassess the victim after two minutes. It will be up to you to determine if a victim has had a return of spontaneous circulation upon your arrival and determine if chest compressions should be discontinued (p. 36).

**For kids, call 9-1-1 after five cycles of 30:2:** As before, lay providers are advised to initiate CPR for an unresponsive child who is not breathing, prior to calling 9-1-1. Now, the recommendation is to initiate and continue that CPR for five cycles of 30:2, about a minute longer than the old recommendation. The impact of this is that 9-1-1 calls may come in a little later in the arrest than before implementation of this change. It is hoped, though, that the longer initial effort by the lay rescuer will result in a greater

probability of a successful resuscitation of the child victim (pp. 14, 157).

**No jaw thrust used:** Lay providers will no longer be taught to use a jaw thrust to open the airway for victims suspected of having a head or neck injury. It has been eliminated from lay training because there is a possibility of moving the neck when using that maneuver and because it is not easy to teach or to perform. So, in the event that you respond to a cardiac arrest that is associated with head or neck trauma, lay providers will not have used a jaw thrust, and the head will most likely have been moved from its original position (pp. 21, 157).

**Epi pens & inhalers:** Lay rescuers are now advised to assist victims in using the victims’ own epi-pens and asthma inhalers. In the past, this has not been advised. Perhaps this change will increase the likelihood that a patient will have received these medications prior to your arrival (p. 197).

## CONCLUSION

The 2005 CPR and ECC Guidelines include many changes that have the potential to change the way EMS is delivered throughout

the United States. Although this supplement highlights most of the changes that will have a direct impact on EMS, EMS managers and supervisors should review the Guidelines in their entirety when determining what changes to implement in their systems.

## REFERENCES

1. Wik L, et al: “Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest.” *JAMA*. 293(3):299–304, 2005.
2. Weisfeldt M, Becker L: “Resuscitation after cardiac arrest: A 3-phase time-sensitive model.” *JAMA*. 288(23): 3035–3038, 2002.
3. Berg M, et al: “Post-shock chest compression delays with automated external defibrillator use.” *Resuscitation*. 64(3):287–291, March 2005.
4. Perondi M, et al: “A comparison of high-dose and standard-dose epinephrine in children with cardiac arrest.” *New England Journal of Medicine*. 350:1722–1730, 2004.
5. Jacobs I, Nadkarni V, Bahr J, et al: “Cardiac arrest and cardiopulmonary resuscitation outcome reports ...” *Circulation*. 110(21):3385–3397, Nov. 23, 2004.



In this photo, the Seattle firefighter who was ventilating the patient (see opposite), changed positions with the firefighter giving compressions after two minutes. The switch occurred in less than five seconds with **minimal interruption of chest compressions**.



# Lay Rescuer AED Programs & the 2005 Guidelines for ECC & CPR

By Mary Newman

**Guideline (n):** An official recommendation indicating how something should be done or what sort of action should be taken in a particular circumstance. —Encarta World English Dictionary

The new AHA guidelines for CPR and emergency cardiovascular care are based on an evaluation of 22,000 peer review journal articles conducted by 281 scientists from the international resuscitation community in preparation for the 2005 International Consensus Conference on CPR and ECC Science with Treatment Recommendations. According to the AHA, the 2005 guidelines are “based on the most extensive evidence review of CPR ever published.”

This article examines how the new guidelines impact lay rescuer automated external defibrillation (AED) programs in community settings outside the hospital, highlighting information that program directors of public access defibrillation (PAD) and other on-site AED programs need to know.

### LESSONS LEARNED FROM RECENT RESEARCH

Lessons learned about effective treatment of SCA since publication of the last guidelines in 2000 include the following key developments:

- Lay rescuer AED programs in airports and casinos and first responder AED programs with police officers have resulted in survival rates of 41–74% from out-of-hospital witnessed SCA

when the patient is in a shockable rhythm (ventricular fibrillation or VF), immediate bystander CPR is provided, and AEDs are used within three to five minutes of collapse. In addition, the Public Access Defibrillation (PAD) trial, a large prospective randomized clinical trial funded by the National Heart, Lung and Blood Institute (NHLBI), the AHA and several AED manufacturers, found that lay rescuer CPR-AED programs double the number of survivors from out-of-hospital VF SCA when compared with programs that provided lay-rescuer CPR only.

- If SCA is witnessed, the best course of action is to treat the adult patient immediately with a defibrillator.
- There is a high rate of first-shock success with modern defibrillators. Most patients whose arrests are witnessed and who are treated immediately with AEDs are converted out of VF following the first shock (80–90%).
- Even when the patient is successfully defibrillated, a perfusing rhythm is not normally present for several seconds or minutes. Therefore, rescuers should resume CPR, starting with chest compressions *immediately after*

*a shock is delivered.*

- If the first shock fails and the patient remains in VF, it is most helpful to provide CPR because chest compressions can improve the likelihood that subsequent shocks will be successful.
- The quality of CPR has a strong influence on survival. It is important to provide compressions at an effective rate and depth, to completely release pressure on the chest after each compression and to minimize interruptions in compressions. It is also important to provide effective ventilations and avoid over-ventilation.

### SUPPORT FOR LAY RESCUER AED PROGRAMS

The 2005 guidelines changes represent good news for lay rescuer AED programs. For the first time ever, science solidly supports the value of lay rescuer AED programs in certain locations. Further, the AHA has recognized that physician oversight of lay rescuer AED programs is not essential—as long as a qualified health-care provider, such as a nurse or paramedic, provides program oversight.

In addition, treatment protocols have become simpler and should be easier to remember. Following is a summary of key treatment and programmatic guideline changes. (See Figure A for a list of national CPR/AED training organizations.)

### TREATMENT CHANGES

Lay rescuers who encounter unresponsive victims who are not breathing should provide two breaths and then begin chest compressions. There is no need to assess other signs of circulation. Rescue breaths should take one second and should achieve visible chest rise. One-rescuer CPR for all victims

Figure A: National CPR/AED Training Organizations

American Heart Association	<a href="http://www.americanheart.org">www.americanheart.org</a>	877/AHA-4CPR
American Red Cross	<a href="http://www.redcross.org/services/hss/">www.redcross.org/services/hss/</a>	800/RED-CROSS
American Safety & Health Institute	<a href="http://www.ashinstitute.com">www.ashinstitute.com</a>	800/682-5067
Medic First Aid International	<a href="http://www.medicfirstaid.us">www.medicfirstaid.us</a>	800/800-7099
National Safety Council	<a href="http://www.nsc.org">www.nsc.org</a>	800/621-7619

Figure B: Making AEDs ‘Guidelines 2005 Ready’ (G5R)

Manufacturer	Brands	G5R Plans	Contact Information
Cardiac Science	First Save, Power Heart G3, Power Heart G3 Pro	Software upgrades available in 2006.	www.cardiacscience.com; 800/426-0337
DefibTech	Lifeline, Reviver	Software upgrades for AEDs in field available this spring. May be upgraded directly by end-user free of charge.	www.defibtech.com 866/333-4248
HeartSine Technologies	Samaritan PAD, Samaritan AED	Actively working to comply with new AHA Guidelines. Release date has not been finalized.	www.heartsine.com 866/HRT-SINE
Medtronic	LIFEPAK CR Plus, LIFEPAK EXPRESS, LIFEPAK 500, LIFEPAK 500 DPS	Free upgrades for all devices shipped after Nov. 28, 2005. Upgrades available for biphasic defibrillators shipped before Nov. 28, 2005. Pricing and availability to be announced.	www.medtronic.com 800/442-1142
Philips Medical Systems	Home/On-site, FRx, FR2+, Forerunner	Forerunner: All units can be configured to be G5R now.  FR2+: Units presently shipping can be configured to be G5R now.  Home/OnSite and FRx: All units can be configured for Guidelines-compliant one-shock series and two minutes of CPR now. Units will start shipping in 2006 with CPR Coaching optimized for new Guidelines and minimal CPR interruption. Units already shipped may be updated in 2006 for Guidelines-optimized CPR coaching via a program designed to minimize customer effort and time device is out of service.	www.philips.com/heartstart 800/722-7900
Welch Allyn	AED 10	All existing AED devices are upgradeable to new guidelines. Program outlining upgrade procedure and pricing to be announced in Q1, 2006. New G5R AEDs will ship in Q1 2006.	www.welchallyn.com 800/462-0777
ZOLL Medical Corp.	AED Plus, AED Pro	AED Plus will be G5R before October 2006 using upgrade kit with additional operating configurations to current product and adjustments to graphical user interface. AED Plus covered by ZOLL's Guidelines 2005 Guarantee. Upgrade kits free of charge to customers who purchased AED Plus after Oct. 1, 2005. For other customers, nominal fee will be charged.  AED Pro is G5R. ZOLL Guidelines 2005 Guarantee applies to all versions of AED Pro. Configuration file for upgrading previous versions to G5R available from ZOLL at no cost. Modifications require software changes only—no hardware or labeling changes necessary.	www.zoll.com 800/348-9011

A compression:ventilation ratio of 30:2 has been recommended for all rescuers (lay or health-care provider) who are acting alone in a resuscitation attempt of victims of all ages (except for newly born).

(except newborn infants) should now be provided at a ratio of 30 compressions to two breaths. When any rescuer witnesses SCA and an AED is immediately available on site, the rescuer should treat the victim with the AED immediately. For treatment of VF SCA, rescuers should provide one shock with the defibrillator and immediately resume CPR, starting with chest compressions. (Previously three stacked shocks were recommended.) Strong chest compressions are critical to resuscitation success. Rescuers should push hard and fast (at a rate of 100 compressions per minute), allow the chest to fully recoil between compressions and strive to minimize interruptions in compressions.

“For the lay rescuer who witnesses an SCA, the treatment is the same—retrieve the AED and administer a shock immediately if indicated,” says Roger D. White, MD, of the Mayo Clinic, Special Contributor to the 2005 Guidelines and member of the AHA ACLS Committee. “What is different is resumption of chest compressions immediately after the first shock is delivered. If the first shock doesn’t work, then the patient likely will benefit from CPR.”

“While it is true that there are circumstances in which an expanding body of evidence indicates that CPR preceding the first defibrillation shock might be advantageous in terms of shock success and patient outcome, this circumstance almost never prevails in settings in which lay rescuers are likely to use an AED,” said White. “Rather, it is applicable to EMS responders, for whom the time to reach the victim is typically considerably longer. Thus, for lay rescuers a shock-first policy, followed by CPR, is the optimal sequence.”

Another change is recognition that some patients will benefit most from a shock first, while others will benefit most from CPR first. For EMS providers, one of the most

challenging aspects about the decision to shock first or provide CPR first is when to do which intervention first. This is why we recommend that unless the event is witnessed or the rescuer is using a smart defibrillator that indicates otherwise, the rescuer should provide CPR first. When the response time exceeds five minutes, there is evidence that CPR first may be beneficial. Evolving and already available ECG analysis technology will enable devices to determine whether the patient needs CPR or shocks first.

### PROGRAM CHANGES

Lay rescuer AED programs in places where SCA is likely to occur are now considered a Class I recommendation. These locations include sites similar to those in the PAD trial (i.e., sites with a history of at least one SCA every two years or sites that have more than 250 adults over 50 years of age present for more than 16 hours a day). For instance, the AHA supports placement of AEDs in targeted public areas, such as airports, jails, casinos, sports arenas, gated communities, office complexes, doctor’s offices and shopping malls. Qualified health-care providers may provide oversight of lay rescuer AED programs. Previously, physician oversight was recommended.

“This is the first time that AHA guidelines have designated PAD programs in places SCA is likely to occur a Class I recommendation,” says Mary Fran Hazinski, RN, clinical nurse specialist from Vanderbilt University and Senior Science Editor of the 2005 Guidelines. This does not mean merely AED placement, Hazinski noted, citing some cases in which AEDs were available but left unused, and others in which AEDs were used but rescuers did not know how to perform CPR when prompted by the devices. “There is a difference between AEDs and AED programs,” Hazinski emphasizes.

### ACTION CHECKLIST FOR EFFECTIVE LAY RESCUER AED PROGRAMS

What do you need to do to make your lay rescuer AED program as effective as possible? According to the new guidelines, attention to the following elements will help:

- Identify a qualified health-care provider to provide program oversight.
- Develop, practice, and follow a written response plan.
- Identify and train likely rescuers, taking into account the need for refresher training and rescuer turnover. Remember that SCA victims may need CPR, treatment with an AED or both, so rescuers should be prepared to not only to use the AED but also to provide quality CPR.
- Be sure the program is integrated with the local EMS system.
- Develop and implement a process of ongoing quality improvement that feature routine inspections of AED devices and electrodes, and evaluation of post-event data including response plan effectiveness, rescuer performance, and AED function.

### THE BOTTOM LINE

Who shall live? Who shall die? The answer lies in the speed with which the SCA victim receives effective treatment. The most effective treatment is that which arrives within minutes of collapse. It does not matter who provides CPR, as long as it is provided quickly and effectively. It does not matter who carries the AED as long as it is used quickly and effectively. The type of AED used is less important than the speed with which it is used. And yes, the quality of CPR matters.

In the end, the most important determinant of survival from SCA is the presence of trained rescuers who are ready, willing and able to intervene effectively. Communities that want to make a difference should work to increase awareness about SCA as a leading cause of death, train their citizens in CPR and AED use, and make AEDs readily available in high-risk settings. When the vital role of bystander acumen, action, and access to lifesaving equipment is fully recognized, survival from SCA will become the rule, rather than the exception.



# Frequently Asked Questions

**What do these changes** mean for directors of lay rescuer AED programs? Following are answers to some frequently asked questions. Feel free to copy this page and distribute to program directors in your area.

**Q: What is the rationale for the change from a 15:2 compression:ventilation ratio to a 30:2 ratio, and has anyone studied the effects of this change on rescuer fatigue?**

**A:** Although no studies have specifically compared the effectiveness of the 30:2 compression:ventilation ratio with the 15:2 ratio on survival or differences in rescuer fatigue, a growing body of research indicates that interruptions in compressions can have a detrimental effect on outcome. In fact, research shows that in real-world scenarios using the 15:2 ratio, compressions are provided only half the time. A new study, for example, indicates that when lay rescuers interrupt compressions to provide breaths, they typically stop compressions for 15 seconds. This means circulation ceases and the rescue effort retreats to baseline.

“We believe that providing more compressions and fewer breaths will provide a better match for patient needs than previous protocols,” says Michael Sayre, MD, emergency physician from The Ohio State University and chair of the AHA BLS Committee and president of the SCA Network.

Although rescuer fatigue also affects outcome, it is better for the patient if the rescuer continues fast, forceful chest compressions (“push hard, push fast”) than to pause too often for ventilations, pulse checks or rhythm assessment. This is because providing ventilations at a “normal” rate is less important than previously realized, and pulse checks are unreliable at best, even when performed by highly skilled health-care providers. To compensate for rescuer fatigue, experts recommend switching rescuers every two minutes, if possible.

“There are no data to indicate that the 30:2 ratio is more or less tiring than the 15:2 ratio. It is probable that rescuers will tire more quickly with the new ratio, but if

this is better for the patient, then it is a desirable goal,” according to Sayre. “If a second rescuer is available, then switching every two minutes will likely be helpful. If the rescuer is alone, there is no good way to get around the challenge of rescuer fatigue.”

An additional benefit of selecting the 30:2 ratio as a universal protocol for all patients (except newborns) is that it is expected to improve learning and retention and make application in real life more realistic.

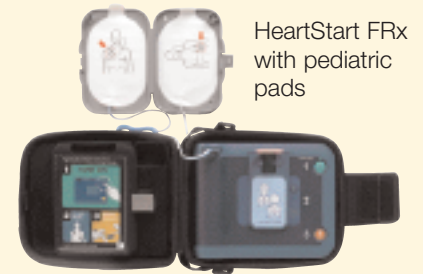
**Q. Do the new guidelines mean there is renewed emphasis on CPR and defibrillation is less important?**

**A.** Yes—and no. Although there is a renewed emphasis on CPR, defibrillation is still essential. Decades of research have supported the importance of CPR and recent studies continue to validate its importance. The quality of CPR matters and patients will benefit from fast, forceful chest compressions delivered with minimal interruptions. At the same time, defibrillation is still critically important, especially in the first few minutes after collapse.

“I share the concern,” says White, “that whenever we try to prioritize a particular maneuver, other maneuvers will be misunderstood as less important. Fortunately, because of the effectiveness of modern AEDs, in cases of witnessed VF in which the AED is used immediately, resumption of chest compressions after the initial shock should expedite rapid restoration of sustained spontaneous circulation.”

**Q. What about the use of AEDs to treat children?**

**A.** Although VF is relatively uncommon in children, it does occur in 5–15% of pediatric SCA cases. In these cases, rapid defibrillation can improve outcomes. For children ages one to eight, a pediatric dose of



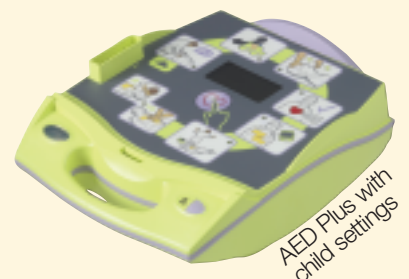
electrical therapy should be used if possible. Some AEDs adjust the dosage through pediatric dose-attenuator systems; others use different methods to adjust to a pediatric dose. If a child is in VF and a device with pediatric capabilities is not available, a standard AED should be used.

The guidelines do not recommend for or against AED programs in locations with children routinely present, such as schools, but they do recommend that AED programs established in such locations should install AEDs capable of administering pediatric doses.

Scientific evidence is insufficient to recommend for or against use of AEDs in children under age one.

**Q: We plan to start a new on-site AED program at our health club. Should we wait until training courses have implemented the new guidelines?**

**A.** No. In the meantime, you could lose an opportunity to save a life. Previous AHA guidelines and courses based on those guidelines have helped save many lives. If you do not already have an on-site AED program and your location is considered a relatively high-risk site for an SCA event, do not hesitate to get started.





LIFEPAK 1000 AED with child electrodes

You can update potential rescuers once new courses become available. All nationally recognized CPR-AED training programs expect program materials to be updated by the spring or early summer of 2006.

"These new guidelines do not imply that care based on earlier guidelines is either unsafe or ineffective, including the use of AEDs that conform to those earlier guidelines," according to Jerry Potts, PhD, director of science, AHA ECC Programs. "For this reason and because of the critical importance of providing immediate care to a victim of sudden cardiac arrest, the AHA encourages implementation of (and training for) lifesaving medical emergency response plans (including AED programs) to continue without interruption or consideration of the pending publication of revised training materials."

"The old guidelines are still good," says Sayre. "They definitely resulted in saving lives. The main difference is that the new guidelines will make resuscitation easier to learn and easier to accomplish."

"Nothing needs to be on hold," adds Hazinski.

**Q: We just implemented a corporate-wide AED program that involved training of an extensive network of potential rescuers. Do we need to update training for everyone immediately or can this be done gradually?**

**A.** The new guidelines reflect the latest in resuscitation science and offer what is considered by experts to provide the best-known care for SCA victims. It is reasonable and defensible for entities with AED programs to gradually phase in the new guidelines. If your corporation develops and implements a policy to gradually train

For children ages one to eight, a pediatric dose of electrical therapy should be used if possible. Some AEDs adjust the dosage through pediatric dose-attenuator systems; others use different methods to adjust to a pediatric dose. If a child is in VF & a device with pediatric capabilities is not available, a standard AED should be used.

potential rescuers according to the new guidelines over a period of two years, for example, this is a reasonable and prudent course to follow.

"We hope that EMS systems and PAD programs will implement the new guidelines as quickly as they can because we believe this will improve survival. The old way works, but the new way can work even better," says Sayre. "However, we know people need new training materials and we know that programmatic changes take time."

**Q: Do we need to be concerned about liability risks if it takes our organization some time to fully implement the new guidelines?**

**A.** According to the AHA guidelines published in Circulation, "These new recommendations do not imply that care involving the use of earlier guidelines is unsafe. In addition, it is important to note that these guidelines will not apply to all rescuers and all victims in all situations. The leader of a resuscitation attempt may need to adapt application of the guidelines to unique circumstances."

Richard A. Lazar, Esq., CEO of AED Risk Insights, publisher of the AED Law Center and member of the SCA Network Board of Directors, says that regardless of the way the new guidelines are ultimately viewed by the legal and public policy communities, immediate implementation is not possible. "You can't expect these changes to occur overnight," says Lazar. "According to market estimates (Frost & Sullivan, 2005), there are approximately 300,000 AEDs in public settings in the U.S. In addition, there are probably millions of trained rescuers nationwide who may need to be retrained. It's fair to say it

will take time to update so many devices and rescuers. In my view, at least two years is a reasonable transition period. It certainly is unreasonable to expect the market to move more quickly."

**Q: When can we expect AED companies to update their software to reflect the new guidelines?**

**A.** All AED companies are working to update their software to reflect the new guidelines and make them "Guidelines 2005 Ready" or G5R. Some models can be reconfigured without software modifications. Others require installing software updates. Changes will include adapting to the one-shock protocol and adding verbal prompts to resume chest compressions. For device specific information, see Figure B (p. 31).

**Q. Do the new guidelines indicate which defibrillator waveform is superior for patient outcome?**

**A.** Defibrillators on the market include monophasic waveform defibrillators and both fixed and escalating biphasic waveform defibrillators. According to the guidelines, no specific waveform (monophasic or biphasic) is consistently associated with a rate of return of spontaneous circulation (ROSC) or rates of survival to hospital discharge after cardiac arrest.

Most lay rescuer AED programs use biphasic devices. According to the guidelines, none of the available evidence has shown superiority of either nonescalating- or escalating-energy biphasic waveforms for termination of VF. Rather, it is likely that other factors such as the interval from collapse to CPR or defibrillation have a greater impact on survival than specific waveforms or energy levels.