Editorials

The Most Important Changes in the International ECC and CPR Guidelines 2000

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Background

The release of new resuscitation guidelines has a profound effect on clinical practice and on resuscitation teaching. New guidelines produce changes in the marketing and sales of resuscitation products. New guidelines stimulate discussions and debates surrounding the evidence and the rationale. We recognize the strong possibility that many people will concentrate on just a small number of specific details and will overlook the major conceptual changes in how we developed the guidelines and in the basic principles that provide the foundation for these new guidelines. In the following sections we summarize what we consider significant revisions and innovations in resuscitation concepts and principles.

1. Resuscitation Guidelines Now Internationally Developed, Science-Based, and Evidence-Based

The Guidelines 2000 Conference was a fulfillment of important changes that have been under way since 1992. The most important changes are expressed in the subtitle of the conference name: "an international consensus on science." The conference was part of an international process, culminating in an international scientific collaboration, fulfilling a mission to produce international guidelines. In addition, for the conference to succeed as a consensus on science, participants had to be strongly committed to the principles of evidence-based guideline development.

At the 1992 guidelines conference, an international panel of experts on resuscitation set a goal to make international resuscitation guidelines as consistent as possible by the year 2000. If all scientists review the same science and evaluate it using the same criteria, they reasoned, we should come to the same conclusions and recommendations about how to resuscitate patients. This goal of a single international version of evidence-based, scientific resuscitation guidelines is now a reality with the publication of this document. These international guidelines have grown from several years of planning.
and review of evidence, reaching a pinnacle at the Guidelines 2000 Conference, the forum for the final presentation and discussion of the draft recommendations.

The 1999 Evidence Evaluation Conference and the Guidelines 2000 Conference were not just new versions of the ECC and CPR conference of the American Heart Association with some invited guests from non-AHA organizations. The participating international leaders ignored parochial issues of meeting venue, financing, and numbers of participants. Instead, the international leadership took the only step that could give us truly international guidelines: both AHA and non-AHA experts and consultants occupied every decision-making position that could influence the final conclusions. These positions included panel chairs, expert presenters, expert reviewers, first draft authors, discussion group leaders, peer reviewers, and editorial board members. Regional and national differences seemed to vanish as participants concentrated on review of evidence, critical appraisal, and debate about conclusions.

We can develop valid resuscitation guidelines only by review of all the science and all the evidence published internationally, including non–English-language sources. Because good research is being performed and published around the world, guideline developers must have a mechanism to capture this international evidence. The need to capture the world’s scientific conclusions created a daunting task that required international planning and consultation. The emphasis on international participation came not from a sense of hospitality but from a sense of quality improvement.

Because of concern that some participants and experts would be unfamiliar with the principles of critical appraisal and evidence-based guideline development, a Research Task Force, with international liaisons, was appointed by ILCOR and the ECC Committee/Subcommittees. The objectives of the Task Force were to specify how to perform critical appraisal of scientific literature and, in particular, how to develop evidence-based scientific guidelines. The Task Force produced a consensus document to explain evidence-based guideline processes to all participants. This document was pilot-tested multiple times with appropriate revisions and modifications after each of 3 evaluation meetings: the Mini Evidence Evaluation Conference, March 1999; the Evidence Evaluation Conference, September 1999; and the Guidelines 2000 Conference, February 2000. This statement, titled "How to Develop Evidence-Based Resuscitation Guidelines," supplied the rationale and template for ECC guideline development. An appendix provided a fill-in-the-blanks worksheet that paralleled the steps recommended in the statement. To gain experience and further develop this evidence-based approach, we applied the recommendations to a proposed guideline for an automated external defibrillator (AED) that used an impedance-compensated biphasic waveform.

The template worksheet was then made available on diskette and online. All topic experts for the Evidence Evaluation Conference completed or contributed to a worksheet. Anyone, whether a participant in the conference or not, could propose a new guideline. We asked only that proposers share with us the evidence they had identified and on which they based their proposals. Anyone who wanted to propose a new guideline could obtain a file from the AHA with directions and a template worksheet. (This worksheet can be downloaded from http://www.americanheart.org/ECC/index.html. Interested persons can also download the statement "How to Develop Evidence-Based Resuscitation Guidelines" from this web site.)
2. Expanded Scope of ECC: From Before the Heart Stops Beating to After the Pulse Returns

During the 1990s resuscitation leaders and experts realized that the range of topics discussed in the ECC and CPR guidelines needed to expand. ILCOR, along with the AHA, recognized that there were dangers associated with limiting the guidelines to patients who have lost their pulse and are in full cardiac arrest. Frequently rescuers and clinicians encounter patients "on their way to a cardiac arrest." Proper interventions at this point may stabilize a patient and keep him or her from further deterioration.

In the United States the AHA ECC programs have added a new course called ACLS for Experienced Providers. This course was designed to address a growing list of prearrest conditions that if treated effectively before the heart stopped would not deteriorate to the point of needing resuscitation. Furthermore, these prearrest conditions would still affect the therapeutic approach if the victim continued to deteriorate despite the prearrest treatments. Life-threatening hyperkalemia provides an example of such a prearrest-to-arrest continuum, as does a lethal overdose of a tricyclic antidepressant. Obviously knowledge of the problem of high potassium or a tricyclic antidepressant overdose will drive the therapeutic approach used after the arrest. The well-trained provider would not simply look at the display of a PEA arrhythmia on the monitor and follow the PEA algorithm.

Included in this expanded list of arrest etiologies are a number of conditions that require specific guidelines but until now have not had precise recommendations, eg, asthma, anaphylaxis, electrolyte disturbances, and toxin-induced disturbances in rhythm and blood pressure. Although these were evidence-based and reviewed in a consensus fashion by many international participants, these special resuscitation conditions did not receive full, face-to-face, international, evidence-based review. Complete international, evidence-based review and consensus for these topics is planned for the near future and will be provided in supplemental materials.

3. First Aid, CPR, and Defibrillation in the Workplace

The International Guidelines 2000 present a new section on first aid in the workplace. In the United States and most other countries involved in resuscitation research, workplace injuries are a leading cause of death and disability. Deaths from fatal injuries, however, are still only about one third of all workplace deaths. The remaining two thirds are due to sudden cardiac arrest from ventricular fibrillation or other urgent cardiovascular emergencies. In US workplaces, subject to specific federal regulations, trained lay rescuers are expected to respond to all emergencies. Workplace responders need evidence-based guidelines for the response to these emergencies. Because the ECC and CPR guidelines already provide protocols to manage more than two thirds of life-threatening worksite events, it was natural to add evidence-based first aid guidelines to the existing CPR and early defibrillation protocols. The published research for most first aid topics, however, is insufficient to support higher-level classes of recommendations for all actions. Most first aid guidelines merited only a IIb or an Indeterminate class (classes of recommendation are discussed in Part 1). However, we expect the need for evidence-based first aid recommendations to foster additional research on these topics.
4. Elimination of Pulse Check by Lay Rescuers

Since 1992 many published studies have documented the inability of lay rescuers (and usually healthcare professionals as well) to determine accurately the presence or absence of a carotid pulse.\textsuperscript{7 8 9 10 11 12 13 14 15 16}

When laypersons assess for a pulse, they take too long and are often wrong in their assessment. The large number of errors made in assessing the pulse in simulations is alarming. In actual witnessed arrests, responders may fail to provide chest compressions and fail to apply an AED to people who they mistakenly think have a pulse. This result is called a false-negative (or type II) error—an error that denies a victim an opportunity to be resuscitated. [This topic is discussed in more detail in the editorial titled "Guidelines Based on Fear of Type II (False-Negative) Errors."] By extrapolation from existing data we estimate that this false-negative error will occur in approximately 10% of all of witnessed cardiac arrest victims.

To increase the number of victims who receive appropriate resuscitation, these guidelines recommend elimination of the pulse check for lay rescuers. The training will substitute a simple step: evaluate for signs of circulation (normal breathing, coughing, or movement in response to rescue breaths).

5. Revision and Simplification of Adult BLS Compression Rate and Compression-Ventilation Ratio

The compression rate for adult victims (\text{\geq 8}\ years of age) has been changed to a specific target (approximately 100 compressions per minute) rather than a broad range (80 to 100 compressions per minute). This change should simplify training and retention by making the compression rate for adults and children (1 to 8 years of age) the same. This recommendation is based on the observation that every time compressions are stopped, multiple compressions are required to reestablish adequate blood flow. In addition, many rescuers compress at a rate much lower than the recommended rate. A recommendation to aim for a 25% higher rate should help bring the average rate into an acceptable range.

The adult compression-ventilation ratio has been simplified to a 15:2 ratio for both 1- and 2-rescuer CPR until the airway is secure (then a 5:1 compression-ventilation ratio can be used for 2-rescuer CPR). Again, this recommendation was prompted by the observation that multiple compressions are required before adequate blood flow resumes after each time the rescuer interrupts compressions to deliver a rescue breath. This change will reduce the number of times per minute that chest compressions are interrupted and will increase the number of chest compressions per minute.


For several years educators have criticized the lecture-based approach to teaching and learning CPR. Education experts have rightly criticized loosely scheduled courses packed with information about diverse topics and focused on lectures rather than on acquisition of a small number of critical skills.\textsuperscript{17 18 19} To acquire CPR skills, participants need hands-on practice; excessive lecture time reduces skills.
practice time. Principles of adult education and evidence documenting the success of video-based learning have led to endorsement and acceptance of video-based teaching techniques. These "practice-as-you-watch" and "watch-then-practice" techniques promote acquisition of skills in skills-based educational programs for lay rescuers.

All innovative educational programs should be pilot-tested and evaluated on objective criteria. The program’s success at teaching is measured by the percentage of participants who can demonstrate satisfactory critical skills. The AHA has adopted a "watch-then-practice" video-based medium, having documented that as the most effective didactic method for skills acquisition. This focus on skills acquisition represents a dramatic shift in the approach to teaching CPR. By the next iteration of these guidelines research should be able to document whether this shift in teaching techniques makes lay rescuers more likely to learn and perform CPR. The more important outcome should be whether this approach increases the frequency of bystander CPR for out-of-hospital cardiac arrest.

7. Outcome-Driven Education and Evaluation

CPR educators should be able to identify the core learning objectives of any CPR course for any participant. CPR education should emphasize these core objectives and should evaluate whether the participants meet these objectives. Regardless of whether a CPR course teaches a lay rescuer or a healthcare provider, the course should be structured to eliminate extraneous material and focus the participant on acquisition of core information and skills. A course that uses skills or written evaluations should also focus on the core objectives. If the participant then fails to achieve the core objectives, the course (including the instructor) may be at fault. This represents a dramatic departure from the old "pass-fail" philosophy that failure was the fault of the participant. It is now clear that when participants fail to learn it may be that instructors fail to teach.

8. Teaching ACLS: The Primary and Secondary ABCD Surveys as a Unifying Approach to Assessment and Management

ACLS training since 1994 has reformulated cardiac arrest treatment away from a rhythm-based treatment approach to a unifying approach based on reviewing the Primary and Secondary ABCD Surveys. All ACLS algorithms in 2000 are oriented around this system, taking the same generic approach to all problems (the primary and secondary ABCD approach), with specific modifications introduced at the second D (differential diagnosis).

The new ACLS for Experienced Providers Course became available in the United States in 1999. The topics addressed in the course were developed to appeal to experienced people who have already taken an ACLS Provider Course. Nevertheless, the ACLS Course for Experienced Providers adopted the primary and secondary ABCD model, noting it to be a logical, uniform, and easily memorized approach.


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With the availability and reported success of fibrinolytic therapy for acute coronary syndromes and ischemic stroke, more emphasis must be placed on what appears to be the major obstacle to early fibrinolytic therapy: patient delay. Patients who may be eligible for fibrinolytic treatment must reach a treatment center and be evaluated within the narrow therapeutic window for administration of these drugs. Although patient delays are addressed in other programs, prehospital providers and Emergency Departments must be organized so that they occupy as little of the therapeutic window as possible. To achieve this goal, prehospital care providers must be able to do the following:

- Screen for patients with a high likelihood of an acute coronary syndrome or a potential stroke; immediately transport these patients to appropriate treatment centers.
- Contact and alert emergency facilities that a candidate for fibrinolytic therapy is en route (prearrival notification).
- Initiate diagnostic (eg, 12-lead ECGs or stroke screening exams) and therapeutic actions when indicated. (Where locally appropriate and authorized, this can include field fibrinolytic protocols and antihypertensive protocols.)

To achieve the goal of treatment within the therapeutic window, Emergency Departments and specialists in emergency medicine must be able to do the following:

- Meet the recommended stroke evaluation targets for patients who are potential fibrinolytic candidates. These targets include multiple steps from arrival to disposition, including door-to-physician evaluation, to CT scan obtained, to CT scan interpreted and fibrinolytic decision made.
- Meet the recommended acute coronary syndrome evaluation targets for patients who are potential candidates for fibrinolytic therapy or percutaneous coronary interventions.

10. Devices for Secondary Confirmation of Proper Tracheal Tube Placement: Techniques to Prevent Dislodgment of Tracheal Tubes

For the first time, the ECC guidelines for PALS and ACLS include 2 new recommendations to use devices and techniques for secondary confirmation of tracheal tube placement and to prevent tracheal tube dislodgment after it has been placed:

- Use a validated secondary confirmation technique to confirm tracheal tube placement, in addition to primary confirmation through physical examination.
- Use a specific, validated technique or device to prevent tracheal tube dislodgment, especially in the prehospital setting or whenever transport of the patient is necessary.

The rationale for these important new recommendations is presented in a companion editorial, "Guidelines Based on the Principle ‘First, Do No Harm.’" The rationale for this step is based less on hard, definitive evidence and more on a philosophy of care (ie, do no harm). These recommendations were driven by an imperative to prevent harm rather than to initiate an intervention because of support from powerful and compelling evidence.

Device May Be as Effective as Compromised Ventilation Using Tracheal Tube

The recent publication of a prospective, randomized trial compared the effectiveness of out-of-hospital ventilations via tracheal tube placement versus ventilations via bag-mask for pediatric emergencies. The results, which confirmed the 2 interventions as equivalent, challenged the concept that ventilation via a properly placed tracheal tube was resuscitation’s "gold standard." The choice of ventilatory support (bag-mask ventilation or tracheal intubation) should be based on the clinical condition of the patient, transport time to Emergency Department care, and the experience, training, and expertise of the rescuers. Proficiency in bag-mask ventilation is mandatory for anyone providing BLS or ACLS in the prehospital setting and is of higher priority than skill in tracheal intubation. In locations where prehospital intubation is preferred, quality assurance monitoring must be in place to document rates of successful intubation and rates and severity of complications. Secondary confirmation of tracheal tube placement (see point 10) should be performed immediately after intubation, during transport, and during any movement of the patient.

12. Pharmacological Therapy for Adult and Pediatric Cardiac Arrest and for Pediatric Arrhythmias With Poor Perfusion

Whenever possible, the pediatric guidelines for drug therapy for cardiac arrest and significant arrhythmias have been made consistent with the pharmacological guidelines for adult resuscitation. The adult evidence-based recommendations, however, may not be the best model on which to base pediatric recommendations. On review of the evidence supporting the effectiveness of antiarrhythmics for adult VF or pulseless VT, only amiodarone received an acceptable, effective classification (IIb). Other traditional agents such as lidocaine, bretylium, and procainamide received an indeterminate rating because valid, prospective, randomized trials confirming effectiveness were absent. Similarly, there is insufficient data in the pediatric population to support any agent beyond a Class IIb recommendation. Most PALS recommendations are classed Indeterminate. A major objective of the Subcommittee on Pediatric Resuscitation is to obtain definitive evidence to answer these clinical questions in time for the next iteration of the guidelines.

13. Support for Family Presence at Resuscitation Attempts

When questioned, most family members state that they would like to be present during the attempted resuscitation of a loved one, especially when the resuscitation attempt involves a child. A number of studies have confirmed the desire of family members to be present either at the last minutes of a loved one’s life or at the recovery of an effective heartbeat. Whenever possible, family members should be given this option, but they will require support and specific attention during the resuscitation. Furthermore, such initiatives require advance planning, discussions among all the staff, and general commitment to work through initial problems. If at all possible, a member of the resuscitation team should remain with the family members while they are in the resuscitation suite. This team member can answer their questions, provide support, and recognize when the family members might need to leave.
14. Honoring Out-of-Hospital No-CPR Advance Directives

In the United States, since 1992 more and more states have instituted regulations that permit EMS personnel to honor advance directives or no-CPR documents/bracelets when they arrive on the scene. For many years the principle followed was "if called, EMS personnel institute all clinically indicated emergency procedures." On arrival of EMS personnel at the location of a pulseless person, the protocols required initiation of resuscitative efforts regardless of futility or the prearrest wishes of the victim. The International Guidelines 2000 strongly encourage all US EMS systems to address this issue and follow the lead of our colleagues from Europe and other countries. Those systems place much emphasis on the important role of EMS responders to support the survivors.

15. Death Pronouncement in the Field, Survivor Support Plans, the Futility of Transport of Patients Needing Continued CPR

There has been little evidence that EMS systems and Medical Control Emergency Departments in the United States have reacted to the large and consistently negative experience with transporting pulseless patients from the field to the Emergency Department. The survival rate of patients who fail to respond to effective ALS care in the field has never been improved by high-speed, potentially dangerous transportation to an Emergency Department. Researchers in Europe report the same dismal outcomes. Unless patients are suffering from rare, specific pathological conditions (eg, hypothermia, drug overdose), there are no in-hospital interventions that will successfully resuscitate patients who fail out-of-hospital efforts. High-speed transport of pulseless patients persists to a large extent because EMS personnel are uncomfortable with having to stop efforts in a victim’s home and, in effect, making such a public acknowledgment of failure. In addition, both family and personnel experience discomfort with leaving a body at the scene. The indignity, futility, and danger involved with these transports, however, must end, as it has in many countries.

The solution requires thoughtful planning for the steps to follow when resuscitative efforts stop in the field. Answers to the following questions require reflection, but the answers are available: what are the legal requirements for death certification? for disposition of the body? for post-event survivor support? This is not a new guideline in the United States. Mature EMS systems such as in Seattle–King County, Washington, USA, have implemented protocols for certification of death in the out-of-hospital setting for >20 years. A recent statement from the National Association of EMS Physicians provides an excellent review of this topic, including a thorough list of recommendations almost identical to the guidelines included in the International Guidelines 2000. These futile transports must stop; a little planning and work are all that is necessary.

Summary

Many people involved with resuscitation have specific interests and enthusiasm. They will review the new guidelines to see how their favorite interventions fared. This essay lists a number of the new guidelines that merit special attention: support for family presence at resuscitations, pronouncing death at the scene rather than after futile transport efforts, honoring advance directives, comparable effectiveness.
of bag-mask ventilation versus tracheal intubation, revision of compression rates and compression-ventilation ratios, and devices to confirm tracheal intubation and prevent tube dislodgment.

Even more important are the new principles and concepts that the International Guidelines 2000 endorse: international guideline science, international guideline development, evidence-based guidelines, training by objectives, expanded scope of ECC to first aid and periarrhythm conditions, avoidance of false-negative (type II) errors, video-mediated instruction, and a philosophy to "do no harm."

The number and magnitude of these new guidelines reflect the dynamic nature of resuscitation at the start of the 21st century. There is great optimism that these new and revised guidelines will help achieve our ultimate objective. This objective is to be ready when fate brings some lives to a premature end. If we are, we can restore more of these people to a high-quality life, ready for many more years of living.

Footnotes

1 With contributions from the representatives of the resuscitation councils of ILCOR, including the Resuscitation Council of Southern Africa, the New Zealand Resuscitation Council, the Heart and Stroke Foundation of Canada, the European Resuscitation Council, the Australian Resuscitation Council, and the American Heart Association; the Members of the Emergency Cardiovascular Care (ECC) Committee and ECC Subcommittees; and the Editors of the Science Product Development Panel, ECC Programs, American Heart Association. R.O. Cummins and M.F. Hazinski are Senior Science Editors, American Heart Association ECC Programs.

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