Cardiopulmonary Resuscitation in the Real World: When Will the Guidelines Get the Message?

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THE GUIDELINES FOR CARDIOPULMONARY RESUSCITATION (CPR) and Emergency Cardiovascular Care (ECC)[1] are probably the most widely implemented and best-known guidelines in medicine. In the setting of cardiac arrest, health care professionals want and need simple, practical, and effective guidelines. As the American Heart Association (AHA) and International Liaison Committee on Resuscitation (ILCOR) revise their Consensus on Science and Treatment Guidelines in 2005, it is imperative to assess how these guidelines are developed. Despite the major reassessment and publication of new CPR and ECC guidelines every 5 to 8 years for the past 3 decades, survival from cardiac arrest remains dismal.[2] Have the guidelines and guideline development process improved or compromised the treatment of patients in cardiac arrest? Do they reflect the reality of cardiac arrest treatment? Are they responsive, or impenetrable, to new ideas and concepts in ECC? Are there ways to improve the guidelines process and, therefore, the guidelines themselves?

The studies by Wik et al[3] and Abella et al[4] in this issue of *JAMA* document a major problem in the treatment of patients in cardiac arrest. Using a sternal pad to monitor chest compressions and ventilations, Wik et al obtained data from paramedics and nurse anesthetists performing CPR on 176 adult patients with out-of-hospital cardiac arrest in 3 cities in Europe. They found that chest compressions were not provided 48% of the time with patients in cardiac arrest. Despite using a compression rate of 121/min, these rescue personnel, with the documented interruptions, delivered only 64 chest compressions per minute.[3] Abella et al,[4] using the same monitoring device to observe 67 in-hospital cardiac arrests, found that patients did not receive chest compressions 24% of the time during the resuscitation. Other problems identified in the CPR segments analyzed included ventilations of 20/min or more (61%), compression rates less than 90/min (28%), and inadequate compression depth (37%). Although neither of these studies was powered to assess patient survival, Abella et al found a trend showing that patients who had longer periods without chest compression had worse resuscitation outcome.

See also pp 299 and 305.

These reports are consistent with previous studies documenting low chest compression rates and high ventilation rates when CPR is performed by health care professionals.[5,6] They also complement studies looking at how laypersons and health professionals deliver CPR in cardiac arrest simulations. Assar et al[7] demonstrated that laypersons taught single-rescuer CPR take an average of 16 seconds for each ventilatory pause. A recent study from our CPR Research Group showed that medical students needed 14 seconds to deliver 2 breaths during CPR and delivered only 43 chest compressions per minute after AHA standard CPR training because of pauses for ventilations.[8] Students taught a simplified chest-compression-only CPR delivered 113 compressions per minute immediately after training and 91 compressions per minute when tested 6 months later.[8]

Thus, laypersons, medics, physicians, nurses, medical students, and other health care professionals do not perform CPR according to published guidelines. However, this conclusion is not surprising. Indeed, studies demonstrating poor retention of CPR skills have documented the poor performance of CPR for more than 3 decades.[9,10]

Does the quality of CPR make a difference in patient outcomes? Although there are no randomized controlled trials (RCTs) to answer this question, observational studies in both experimental models and humans indicate that the quality of CPR is likely to affect patient outcome. Kern et al[11] demonstrated that when animals received realistic 16-second pauses for ventilations, 24-hour neurologically intact survival was 13% compared with 80% in the group receiving continuous chest compressions. Yu et al[12] showed that 100% of animals receiving more than 80 compressions per minute were resuscitated whereas only 10% of those receiving fewer than 80 compressions per minute survived.

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In human clinical studies, Wik et al[13] found that patients who received "good" bystander CPR had significantly better hospital discharge rates than those who had no or poor CPR (23% vs 6% vs 1%). Van Hoeyweghen et al[14] found that patients who received "correct" CPR by laypersons or health care professionals had better 14-day survival compared with patients who received "incorrect" CPR (16% vs 4%). Gallagher et al[15] observed that patients who received "high-quality" CPR were significantly more likely to survive to hospital discharge compared with patients receiving "poor-quality" CPR.

Thus, the clinical data, including the 2 studies in this issue of *JAMA*, imply that current resuscitation guidelines are not being followed, and other observational studies indicate that performing high-quality CPR is important for resuscitation success. Clearly, the quality of real-world CPR must be improved. In the past such inadequacies have been dismissed as an education/training problem. This assumed that health care professionals and laypersons do not adequately learn and retain CPR skills, which leads to medical errors when CPR is performed. But perhaps it is not a question of how well rescuers are being taught and learn the material. In reality, the training courses for health care professionals get more complex with each revision of the guidelines. Some of the skills taught, such as 2 breaths in 5 seconds, are impossible to deliver.

The literature on medical errors suggests that blaming the health care professional and asking him or her to work harder or learn more will only lead to more errors.[16] It is time to be more realistic and change the model used for training laypersons and health care professionals in CPR and advanced cardiac life support (ACLS). The initial step is to accept the fact that human beings will be performing CPR and ACLS and to focus on simplifying the technique. Perhaps only those elements that are most critical for neurologically intact survival from cardiac arrest should be taught—such as the following key elements for out-of-hospital sudden cardiac collapse: "push hard and push fast on the center of the chest without interruption, defibrillate promptly, and don't provide too many rescue breaths per minute." The guidelines include a long list of interventions for sudden out-of-hospital arrest aside from continuous chest compressions and defibrillation. The predictable result of this complex algorithm is that the simple, powerful intervention of continuous chest compression is not provided. Instead, long and possibly lethal interruptions in chest compressions are the norm. The unintended consequences of the complex basic life support/ACLS algorithms are too many interruptions in chest compressions, too many rescue breaths, not enough compressions, and not enough survivors.

The ACLS course has become dramatically more complex than it was 20 years ago, and it now includes modules on stroke, acute myocardial infarction, arrhythmias, pulmonary edema, and shock. Material in the "Special Situations" section includes the management of electrolyte imbalances, anaphylaxis, and asthma. Although this expansion of ACLS was developed with the best of intentions (and we served in leadership roles while this expansion occurred), it is time to reassess the direction of CPR and ACLS training. It is time to return to the core mission: to provide the most appropriate initial care for patients in cardiac arrest and simplify the message to both laypersons and health care professionals.

In 2005, the Guidelines for CPR and ECC will be revised. Several basic premises in the guidelines process need to be reassessed. In a well-meaning attempt to put the guidelines on firmer scientific ground, a standardized system of assessing the literature using evidence-based analysis is being used to answer specific questions. Under the current process, a series of questions were developed and literature reviews are performed in which studies are evaluated by level of evidence and quality of study, with RCTs as the gold standard. If a specific question is not raised by the planning committee, it is unlikely to be addressed in the new guidelines.

The scientific merit of each question is discussed in an international meeting and each Resuscitation Council is free to develop its own guidelines based on the scientific analysis. The 2 observational studies presented in this issue of *JAMA* would probably be classified as evidence level 5, "a case series with patients compiled in a serial fashion but lacking a control group."[17] Other studies performed with mannequins or animals would be evidence level 6 classification, "animal studies or mechanical model studies."[17]

An underlying assumption is that the recommendations in the previous guidelines are included (ie, "grandfathered") without the scrutiny required for suggested changes, an approach that represents a major shortcoming in the guidelines assessment and development process. For example, it might be reasonable to suggest that patients in cardiac arrest receive continuous, uninterrupted chest compressions. Another suggestion might be to change the chest compression-to-ventilation ratio from 15:2 to 100:2 based on the data that patients may be receiving too much ventilation and too few chest compressions. The literature review would find no RCTs addressing these suggested changes and only evidence level 5 and 6 data indicating benefit. The scientific analysis, therefore, would not justify a change in guidelines. Paradoxically, there are often no RCTs to support the existing "grandfathered" guidelines, and the existing evidence may be of poorer quality than the evidence for suggested changes. This policy may hinder the development of a true consensus regarding the best treatment recommendations in 2005.

Given the special concerns about conducting research in patients during cardiac arrest, it is very unlikely that RCTs will be performed in the immediate future to answer key clinical questions. Nevertheless, all recommendations in the guidelines should undergo the same scientific scrutiny, whether or not they are in the previous guidelines, even if more evidence level 5 and 6 studies are used to make the recommendations. By avoiding the "grandfathering" approach, the guideline developers should be able to evaluate all the options and make the best consensus decisions in 2005.

Many patients in cardiac arrest do not receive high-quality CPR, and this observation may affect the success of the resuscitation efforts. This represents a shortcoming of the guidelines development process and current training systems. The CPR and ECC Guidelines are too complex, resulting in patients not receiving known benefits such as chest compressions for extended periods. It is time to reconsider some of the policies and processes used in guidelines development such as the inclusion of previous recommendations without evidence to support them. It is time to simplify the CPR guidelines and educational programs so that all patients who sustain cardiac arrest can receive optimal treatment. It is time to give rescuers and health care professionals the knowledge and skills that can be readily used in the real world to improve the resuscitation of patients in cardiac arrest.

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