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Key Recommendations from the AHA CPR Quality Consensus Statement

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Many of you have likely read (or heard about) the recent publication from the American Heart Association (AHA) on CPR quality, CPR Quality: Improving Cardiac Resuscitation Outcomes both Inside and Outside the Hospital.1 It's being referred to as the "AHA CPR Quality Consensus Statement."

The tremendous ongoing stream of important scientific papers and information being published makes it challenging to "separate the wheat from the chaff" and know which publications are game changers for patient care. However, we believe this consensus statement is a resuscitation game changer for five key reasons:

1. Working a code is at the core of prehospital medicine;
2. CPR is the cornerstone of successful cardiac resuscitation;
3. CPR quality is the most critical aspect of CPR;
4. Our understanding of CPR quality has dramatically improved in the past few years; and
5. CPR monitors/defibrillators and other related technologies are advancing rapidly.

This consensus statement should be a top priority for all CPR providers involved in resuscitation attempts at any level, both inside and outside the hospital. This article highlights the central recommendations from the AHA CPR Quality Consensus Statement to raise awareness around the need to measure and maximize the positive impact of our CPR.

Background

Out-of-hospital cardiac arrest is a leading cause of death in the United States and a major public health problem. More than 500,000 children and adults experience cardiac arrest each year and less than 15% survive.2–4

There are enormous and unacceptable disparities in survival between communities and individual hospitals. There's solid evidence that survival from cardiac arrest is closely linked with the quality of CPR provided, and many believe the huge disparities in survival between communities are in part related to differences in how well CPR is performed.2,5–7

In addition to the AHA goals of reducing the overall incidence of heart disease through prevention strategies, the Emergency Cardiovascular Care (ECC) division of the AHA has established three major impact goals regarding cardiac arrest to be achieved by 2020:

1. To double survival from out-of-hospital cardiac arrest (7.9% to 15.8%);
2. To double the survival rate from in-hospital cardiac arrest in adults (19% to 38%) and to also markedly improve survival rates in children (35% to 50%); and
3. To double out-of-hospital bystander CPR rates (31% to 62%).

These ambitious goals are achievable with appropriate strategic planning, resources and commitment. Improving the quality of CPR delivered nationwide is at the top of the ECC's list of action strategies to save more lives.

The 2010 AHA CPR guidelines already stressed the importance of "high-quality" CPR as the foundation of resuscitation (that's why the traditional linear algorithm you learned and relearned so many times for your ACLS card now looks drastically different with a circular graphic based around ongoing, uninterrupted CPR).

What's become clear, however, is that there's a significant gap between what the 2010 guidelines recommend for CPR quality and what's actually done on a routine basis. It's frustrating to many of us that it can take years before life-saving discoveries in medicine make their way into routine practice.

The explicit goal of the AHA CPR quality consensus statement is to stimulate change on a large scale by giving healthcare professionals and healthcare systems a practical framework, and by providing tools to maximize the quality of their CPR and save more lives from cardiac arrest. The consensus statement discusses CPR topic sections, future direction and final recommendations.

Metrics of CPR Performance by the Provider Team
The main goal of CPR is to deliver oxygen and substrate to the vital organs (the brain and heart) during cardiac arrest. CPR is inherently inefficient; it provides only 10–30% of normal blood flow to the heart and 30–40% of normal blood flow to the brain,8–10 even when delivered according to the guidelines.

This inefficiency emphasizes the need for rescuers to deliver the highest-quality CPR possible. Coronary perfusion pressure (CPP), the difference between aortic and right atrial pressure during the relaxation phase of chest compressions, is the primary determinant of myocardial blood flow during CPR.11–13

Therefore, maximizing CPP during CPR is the principal physiological goal and the focus of resuscitation attempts. Because CPP can't be readily measured, rescuers should concentrate on the five specific components of high-quality CPR that have been shown to improve blood flow or human survival. It's important to note that several of these CPR components are interrelated and shouldn't be considered in isolation.

CPR Quality Metrics Recommendations
1. Chest compression fraction (CCF), or the proportion of time chest compressions are performed during a cardiac arrest: >80%;
2. Chest compression rate: between 100–120 compressions per minute;
3. Chest compression depth: >50 mm in adults and >1/3 anterior/posterior dimension in children and infants;
4. Chest recoil: No residual leaning; and
5. Ventilation: Less than 12 breaths per minute, minimal chest rise.

Understanding the significance of these important components of CPR on hemodynamics and their relative interactions is essential for providers to improve outcomes for individual patients.

For adequate tissue oxygenation during CPR, it's essential healthcare providers minimize all interruptions in chest compressions and therefore maximize the amount of time chest compressions generate blood flow.

It's critical providers push deep enough, push the correct rate, avoid excessive pauses (especially around defibrillation attempts), don't lean on the chest and don't over-ventilate (both rate and tidal volume). The specific details and supporting evidence and rationale for these recommendations are described in the actual consensus statement.

Key Consensus Statement Areas Related to CPR Quality
Monitoring & feedback: Options and techniques for monitoring patient response to resuscitation. The adage "If you don't measure it, you can't improve it" applies directly to monitoring CPR quality. Monitoring the quality and performance of CPR by professional rescuers at the scene of cardiac arrest has been transformative to resuscitation science and clinical practice. Studies have demonstrated that trained rescuers often had poor CCF ratios, depth and compression-ventilation rates that were associated with worse outcomes.7,14–18

With new technology capable of monitoring CPR parameters during CPR, investigators and clinicians are now able to monitor the quality of CPR in real time. Given the insights into clinical performance and discoveries in optimal practice, monitoring of CPR quality is arguably one of the most significant advances in resuscitation practice in the past 20 years, and one that should be incorporated into every resuscitation and professional rescuer program.

The types of monitoring for CPR quality can be classified (and prioritized) into physiological (how the patient is doing) and CPR performance (how the rescuers are doing) metrics. Both types of monitoring can provide real-time feedback to rescuers along with retrospective system-wide feedback. It's important to emphasize that the types of CPR quality monitoring aren't mutually exclusive and several types can (and should) be used simultaneously.

Another significant component of CPR monitoring is capnography. End-tidal carbon dioxide (EtCO2) concentrations during CPR are primarily dependent on pulmonary blood flow and therefore reflect cardiac output.19,20 Failure to maintain EtCO2 at more than 20 mmHg during adult CPR reflects poor cardiac output and strongly predicts unsuccessful resuscitation.21–23

The 2010 AHA Guidelines for CPR and ECC recommends monitoring EtCO2 during CPR to assess blood flow. If EtCO2 is <20 mmHg during CPR, rescuers should try to improve chest compression performance (depth, rate, pauses or leaning). They should also consider a normal value (35–40 mmHg) an indicator of return of spontaneous circulation. (Without an elevated EtCO2, there's no need to stop CPR and check for a pulse.)

The human touch. While CPR monitoring technologies have rapidly advanced, they don't replace the need for human supervision and direction during CPR. Visual observation provides qualitative information about depth and rate of chest compressions, as well as rate and tidal volume of ventilations.

Direct human supervision can also reveal important artifacts (e.g., pads not adhering to chest or similar technical problems with the monitor/defibrillator) or situations such as rescuer-patient mismatch (e.g., a 40 kg rescuer vs. a 120 kg patient), as well as the need for switching chest compressors if a rescuer looks tired.

Team-level logistics: How to ensure high-quality CPR in the complex setting of cardiac resuscitation. While BLS skills are typically taught and practiced individually or in pairs, CPR is usually performed in teams that include multiple rescuers and advanced equipment. Resuscitation team configuration varies widely, depending on circumstances such as location (in hospital versus out of hospital), and setting (field, emergency department, CCU or hospital ward).

Some examples of high-functioning resuscitation teams for both prehospital and in-hospital cardiac arrest are presented at www.heart.org/cprquality. These samples are meant to demonstrate how CPR quality can be maintained with varying team sizes and environments.

CPR & systematic CQI. We've seen that, as with other urgent healthcare conditions, hospitals and EMS agencies with a systematic continuous quality improvement (CQI) approach to measuring and assuring high-quality CPR have the best survival rates. Despite this evidence, relatively few healthcare organizations apply these techniques to cardiac arrest by consistently monitoring CPR quality and outcomes.

As a result, there remains an unacceptable disparity in the quality of resuscitation care delivered, and significant opportunities to save more lives exist. Because of this, a new paradigm has evolved where poor-quality CPR should now be considered a preventable harm.

Every EMS system, hospital and other professional rescuer program should have an ongoing CPR CQI program to provide feedback to the director, managers and providers. CPR CQI programs should implement systems to acquire and centrally store metrics of CPR performance.

System-wide performance (optimally linked with survival rate) should be intermittently reviewed with the aim of identifying opportunities for improvement. EMS quality review meetings can serve as platforms to discuss selected cases of arrest care in detail and provide opportunities for feedback and reinforcement of CPR quality goals.

Debriefing sessions after resuscitations have been shown to be an effective approach to improving resuscitation quality. Over time, lessons learned from both individual teams as well as system-wide performance can provide invaluable objective feedback to systems to pinpoint opportunities for targeted training.

Conclusions

While the science of cardiopulmonary resuscitation continues to evolve, we have a tremendous opportunity right now to improve our CPR performance during resuscitation events both inside and outside the hospital.

Through better CPR quality measurement, training and systems improvement, we can transform cardiac arrest survival and see many more victims walking out of the hospital neurologically intact and quickly back to a normal life. Take the challenge to improve CPR quality. We can do this!

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Table 1: Final AHA Consensus Statement Recommendations

1. High-quality CPR should be recognized as the foundation on which all other resuscitative efforts are built. Target CPR performance metrics include:

a. CCF >80%;
b. Compression rate of 100 to 120/min;
c. Compression depth of ≥50 mm in adults with no residual leaning (at least one third the anterior-posterior dimension of the chest in infants and children); and
d. Avoid excessive ventilation (only minimal chest rise and a rate of <12 breaths/min).

2. At every cardiac arrest attended by professional rescuers:

a. Use at least one modality of monitoring the team's CPR performance;
b. Depending on available resources, use at least one modality of monitoring the patient's physiological response to resuscitative efforts; and
c. Continually adjust resuscitative efforts based on the patient's physiological response.

3. Resuscitation teams should coordinate efforts to optimize CPR during cardiac arrest by:

a. Starting compressions rapidly and optimizing CPR performance early;
b. Making sure that a team leader oversees the effort and delegates effectively to ensure rapid and optimal CPR performance; and
c. Maintaining optimal CPR delivery while integrating advanced care and transport.

4. Systems of care (EMS system, hospital and other professional rescuer programs) should:

a. Determine a coordinated code team response with specific role responsibilities to ensure that high-quality CPR is delivered during the entire event;
b. Capture CPR performance data in every cardiac arrest and use an ongoing CPR CQI program to optimize future resuscitative efforts; and
c. Implement strategies for continuous improvement in CPR quality and incorporate education, maintenance of competency and review of arrest characteristics that include available CPR quality metrics.

5. A national system for standardized reporting of CPR quality metrics should be developed:

a. CPR quality metrics should be included and collected in national registries and databases for reviewing, reporting, and conducting research on resuscitation;

b. The AHA, appropriate government agencies and device manufacturers should develop industry standards for interoperable raw data downloads and reporting from electronic data collected during resuscitation for both quality improvement and research.

Administration and Leadership Operations and Protcols Features 2010 AHA Guidelines AHA CPR Quality Consensus Statement AHA guidelines cardiopulmonary resuscitation cpr CPR quality end-tidal carbon dioxide end-tidal CO2 high-quality cpr quality CPR