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Issue Brief

Out-of-Hospital Sudden Cardiac Arrests: Advancing the Use of Cardiocerebral Resuscitation (CCR) to Improve Survival

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Bystanders and those who respond to an out-of-hospital cardiac arrest often provide incorrect care that does not follow emergency resuscitation guidelines.[1,2] Even many medics, physicians, nurses and other health personnel do not perform cardiopulmonary resuscitation according to current guidelines. As well, survival outcomes vary significantly by race and geography.

This brief analyzes the current guidelines from the American Heart Association (AHA) that use a cardiopulmonary resuscitation (CPR) protocol following a cardiac arrest. It discusses cardiocerebral resuscitation (CCR), a modified chest-compression-only protocol to be used for cardiac arrest due to a primary cardiac event, and which has shown improved survival rates compared to CPR. Finally, it addresses recommendations for population-level implementation of the CCR protocol.

Background

Cardiac arrest, recognized by apparent lack of circulation due to cessation of cardiac pumping, is a significant public health problem.[3] Although progress has been made in recent years to reduce overall cardiovascular disease (CVD), sudden cardiac arrest is still a leading cause of mortality throughout the industrialized world.

Out-of-hospital cardiac arrest (OHCA) is not a reportable disease, so accurate case-count and disease burden remain unknown. Estimates of OHCA treated by emergency medical services (EMS) in 2006 range from 236,000 to 325,000.[4,5] The American Health Association (AHA) and the International Liaison Committee on Resuscitation (ILCOR) have made numerous revisions to their guidelines for cardiopulmonary resuscitation, yet very low survival rates persist at between 5-10%.[6]

The CPR procedure seems to be too complicated for practical application. One recent study found that health care staff conducted compressions lower than the recommended rate while administering ventilations at higher than the recommended rates.[7]

Additionally, CPR may not be appropriate to the circumstances for which the current guidelines designate. Current guidelines promote essentially the same approach for two different disease conditions.[8,9] In respiratory failure

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(such as drowning, asthma attack or drug overdose), a lack of oxygen and hypotension eventually result in a secondary cardiac arrest, and ventilation is always required because the oxygen stores are depleted. However, in a primary cardiac arrest, arterial blood is typically still saturated with oxygen, so ventilations are not immediately needed.

Chest compressions are the most important factor in allowing oxygenated blood to reach vital organs. Compressions help maintain sufficient coronary pressure during the diastolic phase of heart contraction, when the heart relaxes and blood fills the ventricles, as well as in the contraction phase of the heart.[15] Continuous chest compressions are required in order to get to the desirable pressure for circulation. Cessation of compressions, even for as little as four to five seconds, can be detrimental to the survival outcome by decreasing the pressure of blood entering the heart, and thus decreasing delivery of oxygen to organs and rapidly decreased blood flow to the brain.[10, 11, 12]

Survival rates for out-of-hospital cardiac arrest (OHCA) have not improved over the past few decades despite numerous changes to the resucitation guidelines.

Geographic variations have been noted in survival outcomes. One study published in 2008 reports that overall EMS–treated OHCA survival ranged from 3% in Alabama to 16% in Seattle.[13] The variations may reflect differences in bystander CPR and defibrillation programs, EMS personnel experience, and/or the types of interventions conducted by EMS responders. In addition to geographic variation, racial minorities experience higher incidence of OHCA and thereby depend more heavily on effective response. One study of adults in New York City found an age-adjusted OHCA incidence of 10 per 10,000 for African Americans, 7 for Hispanics and 6 for Whites." [14]

In each area that CCR has been implemented, neurologically intact survival rates have increased.

Comparison of Interventions

Current guidelines for CPR call for chest compressions followed by ventilations in a 30:2 ratio.[15] This protocol is taught to and implemented by medical personnel and interested public citizens. Certification for mastering the technique is also available as proof of obtaining the skill.

These protocols, however, do not translate well into practice. Bystanders to a cardiac arrest event hesitate to administer CPR. They are uncertain they can perform it correctly and/or they do not want to breathe into a stranger's mouth.[16] When bystanders do attempt to administer CPR, they often do so incorrectly. The pause between ventilations and chest compressions is often too long and the chest compressions are too shallow and/or at too slow of a rate.[17] Again, ventilations are not needed for a primary cardiac arrest that does not involve a respiratory incident. In fact, such ventilations can decrease survival rates.

Many cardiac arrests happen in residential settings, and 47% of all sudden cardiac deaths occur in an out-of-hospital setting.[18] The first few minutes after an attack are crucial for providing aid to prevent neurological damage and to improve survival rates. Bystanders are an important link in the chain of survival.

The new CCR protocol, developed by the University of Arizona Sarver Heart Center Resuscitation Group[19] has been shown most effective in a bystander-witnessed ventricular fibrillation.[20] CCR, unlike CPR, does not involve performing ventilations on the cardiac arrest victim.[8] This CCR protocol is made up of two separate arms: one for the general public witnessing the arrest and one for the EMS when they reach the scene. The protocol for the general

public calls for chest compressions at a rate of 100 compressions per minute until EMS can reach the scene to provide defibrillation and further aid.[21]

A study of CCR in two Wisconsin counties (Rock and Walworth) found CCR effective at increasing neurologically intact survival rates.[22] The neurologically intact survival of witnessed cardiac arrest with a shockable rhythm increased from 15% during the three years using the 2000 American Heart Association guidelines to 40% during the three years after the new CCR protocol was introduced.[23] Neurologically intact survival is an especially important factor in the subsequent quality of life for the survivor. This study focused training on EMS and firefighters and did not actively train the general public in the technique. Public training could further bolster the likelihood of timely intervention and the rate of neurologically intact survival.

Learn CCR on YouTube:

"Continuous Chest Compression CPR – Mayo Clinic Presentation"

The CCR protocol offers many benefits in cardiac arrest situations where it is indicated. Bystanders are more likely to administer CCR compared to CPR because the technique is easy to master and they do not need to ventilate into a stranger's mouth.[24] CCR is easy to teach to the public. It takes about 15 minutes to teach, and is already being taught by the Madison Chapter of the American Red Cross and by the Madison Fire Department.

Dane County has started an initiative, Call & Pump, to improve OHCA survival rates through education and awareness training of CCR.

http://danecallandpump.org

While the CCR protocol promises several benefits, implementing this new protocol also poses some challenges. Those learning the protocol need to understand when it is appropriate to use CCR and when CPR with ventilations may be needed (cardiac arrest due to a respiratory event). Also, the American Red Cross does not currently offer certification in CCR so standardized training is not readily accessible.

Recommendations

The CCR protocol is only one part of a solution to heart disease. Primary prevention – preventing cardiac arrest from happening – involves lifestyle choices, genetic factors, preventive care and environmental factors that support healthy lifestyles. The CCR protocol is an important secondary prevention strategy to improve neurologically intact survival once attacks have occurred.

Red Cross training and certification could facilitate widespread state and national adoption of CCR. Such certification creates a standard of quality for training and mastery of the skill that can be consistently replicated across the country.

American Heart Association guidelines include some elements of CCR, but they do not include all of the CCR recommendations. The American Heart Association could incorporate CCR for cardiac events leading to a cardiac arrest while keeping the CPR protocol intact for respiratory events leading to a cardiac arrest.

Standard data collection on OHCA events will allow proper surveillance of trends, with tracking and reporting of disease burden and mortality.[25] The American Heart Association has suggested that OHCA be a reportable disease.[26] Others suggest that publications include OHCA survival rates when rating cities for livability and health.[27]

Communities, equipped with data on OHCA events and outcomes, can best target primary and secondary prevention programs. Further lessons may be available from communities with high out-of-hospital survival rates.[28] CCR protocols, supported by standard and widespread training along with population-level data monitoring, offer the potential for significant pubic health impact.

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