CONTRA COSTA COUNTY EMERGENCY MEDICAL SERVICES AGENCY

EMS Best Practices

SPECIAL EDITION
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CPR QUALITY

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INTRODUCTION

In July 2013, an important consensus statement on CPR quality was issued by the American Heart Association (AHA). The document can be accessed by this link: http://circ.ahajournals.org/content/early/2013/06/25/CIR.0b013e31829d8654.full.pdf. This special edition of EMS Best Practices is dedicated to summarizing the content of that document, along with additional information about early defibrillation and transport. Around the nation, improving the quality of CPR has led to increased survival rates. While we have likely doubled our survival rate in the past 20 years in Contra Costa, we believe it's possible to double it again with optimal CPR.

THE FIVE MOST CRITICAL ASPECTS OF CPR QUALITY AND WHY THEY ARE IMPORTANT

Critical Aspect / Definition	Importance
Chest Compression Fraction of at least 80%: Chest compression fraction (CCF) is the percentage of time that chest compressions are occurring during resuscitation, starting from the earliest recognition of the arrest to the end of resuscitation. When the patient is without a perfusing pulse, CCF should occur at least 80% of the time. Pauses to provide ventilation by bag-valve-mask need to be no more than 3 seconds, and pauses to defibrillate need to be 10 seconds or less.	Chest compressions create blood flow and perfusion of the coronary arteries and heart muscle. A well perfused heart is much more likely to restart. Without that restart, survival won't occur. When chest compressions stop, perfusion rapidly diminishes. Keeping compressions as continuous as possible increases the possibility for successful defibrillation.
Compression Rate Between 100 and 120 per minute: Use of a metronome has been shown to be very helpful in keeping rates in the recommended range.	Survival is optimized when compressions are delivered at this rate. Between compressions, the heart refills with blood. When the rate is too fast, there is not sufficient time for refilling, and diminished blood flow is the result.
Compression Depth of at least 2 inches: In adults this is the proper depth. In infants and children, it is at least one-third of the anterior-posterior dimension of the chest.	Inadequate depth leads to less blood flow. As with CCF and rate, blood flow is key, and survival is diminished when the depth of compression isn't adequate.
Full Recoil of the Chest: During CPR compressions, the chest needs to return to its full expansion. Leaning on the chest prevents full expansion.	The heart refills between compressions, and without full recoil, refilling is not maximized. Similar to the rate issue, less refilling means less blood flow, and less blood flow means less survival.
Avoidance of Excessive Ventilation: Proper ventilation during CPR needs to be just enough to cause minimal chest rise. The rate should be less than 12 per minute – ideally in the 8–10 range when an advanced airway is in place.	Excessive ventilation has several potentially harmful consequences. Increased gastric distention may lead to vomiting and impairment of the airway. Excessive chest pressures from high ventilation volumes or rate impede blood return to the heart.

CONTRA COSTA HEALTH SERVICES

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USE A METRONOME TO HELP GIVE THE RIGHT DOSE OF CPR

Compressions and ventilations can be considered in the same way as a drug dosage—more is not always better. An "overdose" of compressions and ventilations can be harmful and that is why use of a metronome is now being required during all resuscitations.

LEADERSHIP AND QUALITY IMPROVEMENT

The AHA has long recommended organized resuscitation efforts and has recognized the value of a leader. In our setting, the leader's key responsibilities are to assure that compressions are being done properly, that ventilations are being done properly, and that all other procedures (e.g. airway and vascular access) do not impede the resuscitation by causing pauses in compressions.

Quality improvement in CPR means measurement of our CPR and acting upon that measurement to improve subsequent resuscitations, both by giving prompt feedback to our crews as well as designing and implementing training to emphasize the critical aspects of resuscitation. We now have the capability to measure compression rate and chest compression fraction with our monitor-defibrillators. By use of end-tidal CO2 monitoring, we can measure ventilation also.

Aside from measurement of key events during resuscitation, another important tool that we want to implement in a standard manner is the use of an immediate debriefing or "huddle" among rescuers to assess the resuscitation. Among the items that should be discussed is the identification of the leader, whether the scene was orderly, whether the quality of CPR was monitored by the leader, whether the defibrillator was applied in a timely fashion, and whether pauses in CPR were minimized. While these observations may be somewhat subjective, there is evidence that the positive impact of debriefings (on the quality of subsequent resuscitations) may actually be more effective than epinephrine in leading to improved survival!

TIMELINESS OF SHOCKS

Ventricular fibrillation and pulseless ventricular tachycardia are lethal heart rhythms. Despite this, they are among the easiest dysrhythmias to treat—with defibrillation. The earlier the shock, the better the outcome.

Initial shock: When cardiac arrest is discovered, the earliest critical procedure includes application of defibrillation pads (while CPR is in progress). A shock should be delivered immediately if VF or pulseless VT is noted. The ideal is to deliver a shock within 60 seconds of rescuer arrival at the patient's side.

Charging during compressions: During the course of a 2 minute CPR cycle, the defibrillator should be charged at the 1:45 mark of each cycle. When compressions stop at the 2 minute mark, rapid evaluation of the rhythm and safe delivery of the shock should occur immediately—within 10 seconds of stoppage of compressions.

TRANSPORT DECREASES CPR QUALITY

One potential for significant degradation in the quality of CPR is when a patient is transported to the hospital during resuscitation. During the transition from the scene to the ambulance, key events like defibrillation may not occur, and unless a mechanical compressor is in place, the quality of compressions (both CCF and rate) undoubtedly suffer. For most cardiac arrests in adults, early transport of a pulseless patient shouldn't happen. With each passing minute, the chance for survival decreases, and we should not be reducing that possibility by moving the patient. Scene safety issues as always may play a role, but for the most part, getting a pulse back at scene is the key to cardiac arrest survival.

"Only 3 percent of patients transported without a pulse survive. If a pulse is present the survival rate is 10 times greater."