

## Clinical summary

### CPR quality: Improving cardiac resuscitation outcomes both inside and outside the hospital

#### A consensus statement from the American Heart Association

In June 2013 the AHA released a Consensus Statement on CPR Quality: Improving Cardiac Resuscitation Outcomes Both Inside and Outside the Hospital.<sup>1</sup> This is a follow-up to the AHA's Consensus Statement that was released in March on Strategies for Improving Survival After In-Hospital Cardiac Arrest.<sup>2</sup> The more recent statements highlight a growing body of clinical evidence in hopes of bridging the gap between our current scientific knowledge of CPR quality and its implementation into routine clinical practice in the prehospital and hospital settings.

Here are some key summary points to remember.

#### Epidemiology:

- In the United States, >500 000 children and adults experience a cardiac arrest annually and <15% survive.
- In the pre-hospital setting, among participating centers in the Resuscitation Outcomes Consortium (ROC) Epistry, survival from out-of-hospital arrest ranged from 3.0% to 16.3%.
- In the hospital setting, among participating centers in the Get With The Guidelines-Resuscitation quality improvement program, the median hospital survival rate from adult cardiac arrest is 18%.
- To maximize survival from cardiac arrest, efforts must be focused on optimizing the quality of CPR specifically, as well as the performance of resuscitation processes in general.

#### High quality CPR

The AHA states that poor-quality CPR should be considered a "preventable harm" and that "few healthcare systems apply continuous quality improvement techniques to cardiac arrest." The significant variability in monitoring, implementation and quality improvement (QI) of high-performance CPR are addressed in 5 critical areas for both IHCA and OHCA:

- Minimizing interruptions in chest compressions (compression fraction)
- Providing compressions of adequate rate
- Providing compressions of adequate depth
- Avoiding leaning between compressions (full recoil)
- Avoiding excessive ventilation

#### Best practices for adults

##### Monitoring performance metrics

**Minimize interruptions:** chest compression fraction (CCF)>80%

For adequate tissue oxygenation, it is essential that healthcare providers minimize interruptions in chest compressions and therefore maximize the amount of time chest compressions generate blood flow.

**Our solutions:** LUCAS® chest compression system, TrueCPR™ coaching device, CODE-STAT™ data review software

##### Chest compression rate of 100 to 120/min

Data from the ROC Epistry provide the best evidence of association between compression rate and survival and suggest an optimum target of between 100 and 120 compressions per minute.

**Our solutions:** LUCAS chest compression system, TrueCPR coaching device, metronome in the LIFEPAK® 15 monitor/defibrillator and LIFEPAK 20e defibrillator/monitor with CodeManagement Module™, CODE-STAT data review software

##### Chest compression depth of ≥50 mm in adults and at Least 1/3 the A-P dimension of the chest in infants and children

The 2010 AHA Guidelines for CPR and ECC recommend a single minimum depth for compressions of ≥2 inches (50 mm) in adults. Less clinical information is available for children, but it is reasonable to aim for a compression depth of at least one third of the anterior-posterior (A-P) dimension of the chest in infants and children (≈1. inches, or 4 cm, in infants and ≈2 inches, or 5 cm, in children).

**Our solutions (adults):** LUCAS chest compression system, TrueCPR coaching device

##### Full chest recoil: No residual leaning

Leaning is known to decrease the blood flow throughout the heart and can decrease venous return and cardiac output. Human studies show that a majority of rescuers often lean during CPR and do not allow the chest to recoil fully. Therefore, the expert panel agrees that leaning should be minimized.

**Our solutions:** LUCAS chest compression system, TrueCPR coaching device with recoil reminder

## **Avoid excessive ventilation: Rate <12 breaths per minute, minimal chest rise**

The expert panel supports the 2010 AHA Guidelines for CPR and ECC and recommends a ventilation rate of <12 breaths per minute to minimize the impact of positive-pressure ventilation on blood flow.

**Our solutions:** LUCAS chest compression system with 30:2 compression ratio with flashing light to alert the clinician to perform ventilations, TrueCPR coaching device with airway mode 30:2, metronome in the LIFEPAK 15 device (includes a ventilation reminder for both intubated and non-intubated patients)

## **Best practices for adults**

### **Monitoring and feedback: Patient response to resuscitation**

#### **Monitoring the patient's physiological response to resuscitative efforts**

1. Invasive monitoring: CPP >20 mm Hg
2. Arterial line only: Arterial diastolic pressure >25 mm Hg
3. Capnography only: EtCO<sub>2</sub> >20 mm Hg

**Our solutions:** Invasive pressure (IP) in the LIFEPAK 15 monitor/defibrillator and EtCO<sub>2</sub> in the LIFEPAK 15 monitor/defibrillator and LIFEPAK 20e defibrillator/monitor with CodeManagement Module.

\*Note—"A reasonable surrogate for CPP during CPR is arterial relaxation ("diastolic") pressure, which can be measured using a radial, brachial, or femoral artery catheter. These closely approximate aortic relaxation pressures during CPR in humans."<sup>3</sup> Performing good quality compressions guided by EtCO<sub>2</sub> is still the key recommendation.

#### **How the rescuers are doing: Monitoring CPR performance**

Monitors to measure CPR performance are now widely available. Routinely available feedback on CPR performance characteristics includes chest compression rate, depth, and recoil. Currently, certain important parameters (CCF and preshock, perishock, and postshock pauses) can be reviewed only retrospectively, whereas others (ventilation rate, airway pressure, tidal volume, and inflation duration) cannot be assessed adequately by current technology. Additionally, accelerometers have been shown to be insensitive to mattress compressions (Banville 2011).

**Our solutions:** CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, TrueCPR coaching device, metronome in the LIFEPAK 15 monitor/defibrillator and LIFEPAK 20e defibrillator/monitor with CodeManagement Module.

## **Best practices for adults**

### **Team-Level Logistics: Ensure high-quality CPR in the complex setting of cardiac resuscitation**

To prioritize the optimization of individual components of CPR in the following order:

1. Compression fraction
2. Compression rate
3. Compression depth
4. Leaning
5. Avoiding excessive ventilation

#### **Maximization of CCF**

To achieve a target CCF >80%, careful management of interruptions is critical.

**Our solutions:** CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, TrueCPR coaching device, LUCAS chest compression system

#### **Maximization of CCF**

1. Minimize interruptions for airway placement

If a pause is required, it should be kept as short as possible, ideally <10 seconds.

**Our solutions:** CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, TrueCPR coaching device

#### **Maximization of CCF**

2. Avoid unnecessary pulse checks and minimize perishock pauses

It is important to minimize all pauses. Outcomes have been shown to improve with decreased duration of pauses before shock delivery.

**Our solutions:** CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, LUCAS chest compression system allows shocks without pausing, TrueCPR coaching device with alert for pauses >10sec

#### **Maximization of CCF**

3. Tight regulation of compression rate

It is essential to continue to monitor and adjust for degradation in compression rate over time and after modifications to other parameters.

**Our solutions:** LUCAS chest compression system, CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, TrueCPR coaching device, metronome in the LIFEPAK 15 monitor/defibrillator and LIFEPAK 20e defibrillator/monitor with CodeManagement Module.

### **Maximizing compression depth $\geq 50$ mm**

This parameter is one of the most difficult to achieve because of the physical force required.

**Our solutions:** LUCAS chest compression system, TrueCPR coaching device

### **Maximizing compression depth $\geq 50$ mm**

1. Ensure a firm, hard surface

The 2010 AHA Guidelines for CPR and ECC recommend performing CPR on a firm, hard surface. Backboards are commonly used to achieve target depths.

**Our solutions:** LUCAS chest compression system, TrueCPR coaching device provides accurate CC depth independent of surface (A backboard is still recommended).

### **Maximizing compression depth $\geq 50$ mm**

2. Optimize provider mechanics of compressions

Compression mechanics often degrade over time and rescuers often do not perceive fatigue before skill deterioration. The use of feedback devices, especially visual, can counteract degradation of CPR mechanics to some degree.

**Our solutions:** TrueCPR coaching device

### **Incorporation of mechanical CPR, patient transport**

There is evidence that pre-event “pit crew” team training can reduce the pause required to apply the device. Also, studies of mechanical versus manual CPR in a moving ambulance show less effect on CPR quality when a mechanical device is used.

**Our solutions:** LUCAS chest compression system

## **Best practices**

### **CPR and systematic CQI**

#### **Debriefing, use of checklists, use of monitoring data, integration with existing education systems review/quality improvement**

Review of the quality and performance of CPR by professional rescuers after cardiac arrest has been shown to be feasible and improves outcomes. Despite this evidence, few healthcare organizations apply these techniques to cardiac arrest by consistently monitoring CPR quality and outcomes. As a result, there remains an unacceptable variability in the quality of resuscitation care delivered.

**Our solutions:** CODE-STAT data review software with patient data from LIFEPAK defibrillator/monitors, TrueCPR coaching device, LIFENET® system

## References

1. Meaney P, Bobrow B, Mancini, M, et al. CPR Quality: Improving Cardiac Resuscitation Outcomes Both Inside and Outside the Hospital: A Consensus Statement From the American Heart Association. *Circulation*. June 2013; 0009-7322:1-19.
2. Morrison LJ, Neumar RW, Zimmerman JL, et al. Strategies for Improving Survival After In-Hospital Cardiac Arrest in the United States: 2013 Consensus Recommendations: A Consensus Statement From the American Heart Association. *Circulation*. March 2013; :127:1538-1563.
3. Neumar W, Otto C, Link M, et al. Cardiovascular Care Association Guidelines for Cardiopulmonary Resuscitation and Emergency Part 8: Adult Advanced Cardiovascular Life Support: *2010 American Heart*. October 2010;122:S741

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