THE IMPORTANCE OF CPR WHILE USING AN AUTOMATED EXTERNAL DEFIBRILLATOR

BACKGROUND

Rapid defibrillation has been well established as the primary determinant of successful resuscitation from sudden cardiac arrest (SCA). In fact, the American Heart Association (AHA) and International Liaison Committee on Resuscitation (ILCOR) made early defibrillation (within 5 minutes) a high-priority goal in the Guidelines 2000 for Cardiopulmonary Resuscitation[1]

The recent generation of automated external defibrillators (AEDs) was designed to address this goal by eliminating the need for a responder skilled in the art of heart rhythm interpretation. This innovation enabled the widespread deployment of defibrillators for use by a new class of non-physician responders, and has been spectacularly successful at improving response times and survival in environments such as airports[2], casinos[3], airplanes[4], mid-sized towns[5], and EMS early response systems.[6]

As some EMS organizations have embraced AED technology, however, long-term survival rates have not improved, in spite of significant response time reductions.[7,8,9] These systems have generally been unable to meet the AHA/ILCOR recommendation for defibrillation in less than 5 minutes.

HOW IMPORTANT IS CPR?

Published data has demonstrated that for longer downtime patients, survival can be improved if CPR is given prior to defibrillation.[7,10] Recent laboratory and clinical studies further indicate that CPR interruption for patient assessment, AED voice prompts, and rhythm analysis, may be detrimental for the longer downtime patients typical of EMS response (greater than 5 minutes), but not for short downtime patients.[11,12,13,14,15] Thus, in systems with average response times of greater than 5 minutes, the benefit of earlier response with AEDs may be offset by CPR interruption. Of particular note, the interval between chest compressions and subsequent defibrillation shock has been identified as critically important. Limiting this interruption to less than 15 seconds can result in dramatic positive survival impact.[12,15]

HOW DO PHILIPS AEDs COMPARE?

Philips AEDs have always offered best-in-class performance with regards to the critical interval between chest compression and subsequent defibrillation (Table 1). Our research on this topic led us to develop the QuickShock capability of the HeartStart OnSite and Home Defibrillators, which minimizes the time interval from cessation of CPR to shock delivery. We are continuing to invest in research in this important area. As we learn more, our findings will be incorporated into our products.

Table 1. Best-case CPR interruption interval between CPR and defibrillation shock

DEVICE	CPR INTERRUPTION (SECONDS)	
Philips Heartstart OnSite & Home	< 10	Maximum benefit [12]
Philips FR2+	12*	
Zoll AED+	12	
Cardiac Science Powerheart	16	
Access Cardio AccessAED	17	
Defibtech Reviver	17	
Medtronic LifePak 500	18	
Medtronic CR+	20	
Medtronic CR+ Auto	26	

**Configured for NSA action = pause*

HOW CAN CPR INTERRUPTIONS BE MINIMIZED VIA TRAINING?

Immediately following a defibrillation shock, Philips AEDs issue voice prompts instructing the responder not to touch or disturb the patient. This "no-touch" interval is necessary for artifact-free acquisition of the heart signal for analysis. While the device is analyzing, begin a visual assessment of the patient:

- While the AED is saying, "analyzing, do not touch the patient."
  - Perform a visual check for chest rise, breathing, coughing or movement.

If the AED instructs, "shock advised, charging…" the responder should immediately stand clear of the patient and prepare to deliver another defibrillation shock. If the AED instructs, "paused", or "no shock advised, it is safe to touch the patient" the responder can immediately finish patient assessment and proceed with CPR. Depending on the AED configuration, additional voice reminders will be issued (e.g. "check airway, check breathing, check circulation. If needed, begin CPR"), but the responder can safely proceed with CPR while the reminders are being spoken.

- When the AED says, "paused", or "no shock advised", the responder can proceed immediately to:
  - Confirm visual assessment.
  - Perform a pulse check if required by protocol.
  - Begin CPR without delay.

Using this simple technique with an FR2 series defibrillator, for example, reduces the delay prior to CPR by approximately 12 seconds, a 45% reduction in time between shock and CPR.

HOW CAN THE AED BE RECONFIGURED FOR FURTHER IMPROVEMENT?

Philips HeartStart AEDs are highly configurable. Depending on the characteristics of the emergency response system (see below), it may be desirable to change the default configuration.

The HeartStart OnSite and Home Defibrillators are factory configured to maximize CPR — no reconfiguration is recommended. Should future protocols recommend CPR pause intervals longer than 1 minute, e.g. 1-1/2 or 2 minutes, the AED may be reconfigured accordingly.

The HeartStart FR2 series and ForeRunner Defibrillators are factory configured to continuously monitor a patient's heart rhythm following a "no-shock" decision. In this configuration, CPR will be immediately interrupted to prepare for shock delivery should there be a recurrence of ventricular fibrillation. This configuration is appropriate and highly successful for rapid response systems. For systems with typical response times in excess of 5 minutes, however, recent data suggests that it may be advantageous to proceed with uninterrupted CPR for at least 1 minute, even in the presence of ventricular fibrillation. This is easily accomplished by configuring the AEDs "no-shock advised" parameter to a 1-minute pause, as opposed to the factory default of monitor mode. In addition, both FR2 and ForeRunner can be configured to use a set of more concise, less comprehensive voice prompts. Choosing the short prompts configuration will enable this capability.

Should future protocols recommend CPR pause intervals of longer than 1 minute, e.g. 1-1/2 or 2 minutes, the AED may be reconfigured accordingly. Finally, the Heartstart FR2 may be programmed for a CPR first (prior to shocks) protocol. Simply set the pause key parameter to always on. With this configuration, the "Pause for CPR" button may be pressed to initiate a timed CPR interval prior to initial shocks.

WHO SHOULD CONSIDER RECONFIGURATION OF AN AED?

The benefits of maximizing CPR at the expense of extending time to defibrillation have only been demonstrated for patients with downtimes in excess of 5 minutes, who also receive high-quality manual or mechanical chest compressions. For response times of less than 5 minutes, the data has not shown benefit, and there are hints that delays of defibrillation for the performance of CPR may be counter-productive in these patients.[10] Certainly, it is difficult to argue with the success of extant AED programs, which have met the response time goals for early defibrillation. Based on available data, emergency medical systems that have an expected response time in excess of 5 minutes and responders capable of delivering high-quality CPR, may wish to consider AED reconfiguration as described above.

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