

Synopsis

Along with CPR, early defibrillation is critical to survival when sudden cardiac arrest is caused by ventricular fibrillation or pulseless ventricular tachycardia (VF/pVT).^{1,2} Defibrillation is most successful when administered as soon as possible after the onset of VF/pVT. Conversely, when VF/pVT is prolonged, depletion of the heart's energy reserves can compromise the efficacy of defibrillation unless replenished by a prescribed period of CPR before rhythm analysis. Figure 1 describes the algorithm for performing shocks and other ALS interventions. Minimizing disruptions in CPR surrounding shock administration is a high priority. Currently marketed defibrillators use proprietary shock waveforms that differ in their electrical characteristics. These deliver different peak currents even at the same programmed energy setting, making comparisons of shock efficacy between devices chal-

lenging. Technologies have been developed to diagnose the underlying cardiac rhythm during CPR and to derive prognostic information from the ventricular waveform that may guide patient management. These technologies require further validation before routine use.

While investigations continue to evaluate the optimal waveform and current, escalating energy may also be effective in termination of VF or pVT. Furthermore, optimized pad placement for defibrillation is an important factor in shock success (see Recommendation-Specific Supportive Text, items 4 and 5, and the section Vector Change and Double Sequential Defibrillation).

Recommendation-Specific Supportive Text

1. Emergent electric defibrillation is highly effective at terminating VF/pVT and other hemodynamic destabilizing tachyarrhythmias (please

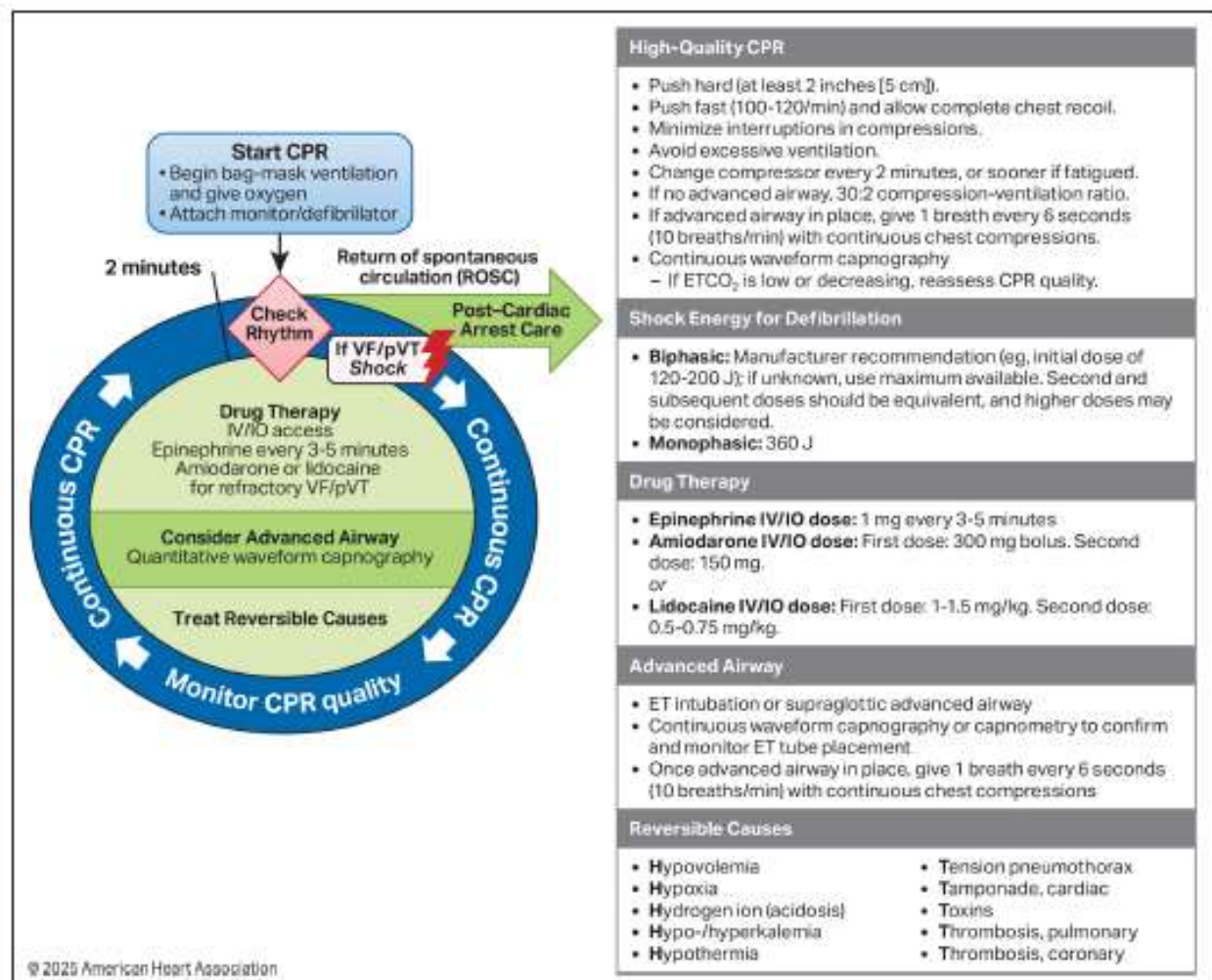


Figure 1. Adult Cardiac Arrest Circular Algorithm.

CPR indicates cardiopulmonary resuscitation; ET, endotracheal; IO, intraosseous; IV, intravenous; pVT, pulseless ventricular tachycardia; and VF, ventricular fibrillation.

see sections on wide-complex and narrow-complex tachycardias or atrial fibrillation/flutter as appropriate).

2. Biphasic waveform defibrillators (which deliver pulses of opposite polarity) expose patients to a much lower peak electric current with equivalent or greater efficacy for terminating atrial³ and ventricular tachyarrhythmias than monophasic (single polarity) defibrillators.^{4–10} These potential differences in safety and efficacy favor preferential use of a biphasic defibrillator, when available. Biphasic defibrillators have largely replaced monophasic shock defibrillators which were last commercially manufactured in the late 1990s, however, some may still be in use.
3. The rationale for a single shock strategy, in which CPR is immediately resumed after the first shock rather than after serial “stacked” shocks (if required) is based upon several considerations. These include the high success rate of the first shock with biphasic waveforms (lessening the need for successive shocks), the declining success of immediate second and third serial shocks when the first shock has failed,¹¹ and the protracted interruption in CPR required for a series of stacked shocks. A single shock strategy results in shorter interruptions in CPR and a significantly improved survival to hospital admission and discharge (although not 1-year survival) compared with serial “stacked” shocks.^{12–14} It is unknown whether stacked shocks or single shocks are more effective in settings of a monitored witnessed arrest, specifically, an in-patient cardiac arrest or cardiac arrest after cardiac surgery where the rhythm change is monitored in real time. (See the section on cardiac arrest after cardiac surgery in Part 10.¹⁵)
- 4 and 5. Commercially available defibrillators either provide fixed energy settings or allow for escalating energy settings; both approaches are highly effective in terminating VF/pVT.¹⁶ An optimal energy setting for initial or subsequent biphasic defibrillation, whether fixed or escalating, has not been identified and is best deferred to the defibrillator’s manufacturer. When a manufacturer’s specified setting is unknown, another approach is to apply the maximum dose setting for that device. A randomized trial comparing fixed 150 J biphasic defibrillation with escalating higher shock energies (200–300–360 J) observed similar rates of successful defibrillation and conversion to an organized rhythm after the first shock. However, among patients who required multiple shocks, escalating shock energy resulted in a significantly higher rate of

conversion to an organized rhythm, although overall survival did not differ between the 2 treatment groups.¹⁷ An observational study comparing fixed 200 J biphasic defibrillation against escalating (200–300–360 J) shocks had similar findings.¹⁸ Different strategies to increase current delivery from biphasic waveform shock have been described, including optimizing pad-skin contact, applying manual pressure to pads during shock delivery (with appropriate self-protective insulation precautions), or vector change of pads. Vector change and double sequential defibrillation are described below.¹⁹

6. There is no conclusive evidence of superiority of one biphasic shock waveform over another for defibrillation.²⁰ Given the variability in electric characteristics between proprietary biphasic waveforms, energy settings are prespecified by the manufacturer for each specific device.

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