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Biphasic versus monophasic shocks for external defibrillation in the prehospital setting

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Background

There have been numerous studies examining the incidence of, and survival from cardiac arrest in the prehospital setting. Since the early 1960's early defibrillation has emerged as the single most important factor for improving outcomes from Ventricular Fibrillation. [1] The 1980's saw the development of the Biphasic Truncated Exponential (BTE) waveform, which was thought to be as effective or superior to standard monophasic pulses in achieving the return of an organised rhythm, whilst delivering less energy. The biphasic pulse had been effectively utilised in implantable cardioverter-defibrillators (ICDs) and it was believed that the same technology could be translated to external defibrillation. The defibrillator size and cost are directly related to the waveform shape. The biphasic (reduced energy) waveform allows for smaller, lightweight and cheaper devices to be far more widely disseminated, [2] and in turn could improve timely defibrillation.

Data Source

The Cochrane Library 2004, Issue 4

Search Terms

[Prehospital Search Filter Version 1.0](#) [3]

Defibrillation, Cardiac Arrest, Advanced Cardiac Life Support, Sudden Death, Ventricular Fibrillation, Ventricular Tachycardia, Biphasic, Monophasic

Search Results

Protocols

None

Systematic Reviews

None

Controlled Clinical Trials

"Truncated biphasic pulses for transthoracic defibrillation". Bardy GH, Gliner BE, *et al* [1]

"A prospective randomized evaluation of biphasic versus monophasic waveform pulses on defibrillation efficacy in humans". Bardy GH, Ivey TD, *et al* [4]

"Multicentre comparison of truncated biphasic shocks and standard damped sine wave monophasic shocks for transthoracic ventricular defibrillation". Bardy GH, Marchlinski FE, *et al* [5]

"A comparison of biphasic and monophasic shocks for external defibrillation". Higgins SL, Herre JM, *et al* [6]

"Optimal Response to Cardiac Arrest study: defibrillation waveform effects". Martens PR, Russell JK, *et al* [7]

"Transthoracic defibrillation of short-lasting ventricular fibrillation: a randomised trial for comparison of the efficacy of low-energy biphasic rectilinear and monophasic damped sine shocks". Szili-Torok T, Theuns D, *et al* [8]

"A prospective, randomised and blinded comparison of first shock success of monophasic and biphasic waveforms in out-of-hospital cardiac arrest". Van Alem AP, Chapman FW, *et al* [9]

Commentary

The search strategy identified seven clinical trials which compared low energy, biphasic external defibrillation with 200-J monophasic external defibrillation. All studies were prospective and randomised. Five of the seven trials were undertaken in a hospital environment whereby subjects were undergoing Defibrillation Threshold Testing during the insertion of an ICD. These patients were subjected to only short durations of Ventricular Fibrillation and we should remain cautious when comparing their results to those observed in the prehospital environment. Two larger trials were set in the prehospital environment [7, 9] employing emergency medical services and first responders. All seven trials concluded that low energy biphasic defibrillation were equivalent or superior to higher energy monophasic defibrillation. One study [5] reported a reduction in abnormal ST segment changes in the biphasic defibrillation group.

The Bottom Line

The evidence identified from the Cochrane library is supportive of BTE waveforms providing equivalent or superior rates of successful defibrillation to the return of an organised rhythm in cases of out-of-hospital Ventricular Fibrillation.

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