

Biphasic Trial: A randomized comparison of fixed lower versus escalating higher energy levels for defibrillation in out-of-hospital cardiac arrest

Stiell et al, 2007, Circulation 115:1511-7.

Escalating to Physio-Control's highest energy therapy may improve its effectiveness. This cannot be generalized to common low energy/high current waveforms, however.

Objective

To compare Physio-Control fixed low energy to Physio-Control escalating high energy regimens of biphasic waveform defibrillation during out-of-hospital AED use. To contribute to answering the question of which energy level and protocol for treating ventricular fibrillation (VF) is best.

Methodology

This was a multi-center randomized blinded trial of 221 out-of-hospital patients. Patients were defibrillated with Physio-Control LP500 AEDs programmed to deliver either fixed 150/150/150J biphasic therapy or escalating 200/300/360J biphasic therapy. Patients were categorized into two groups: those requiring only one shock, and those requiring multiple shocks. The study's conclusions focused only on those patients receiving multiple shocks.

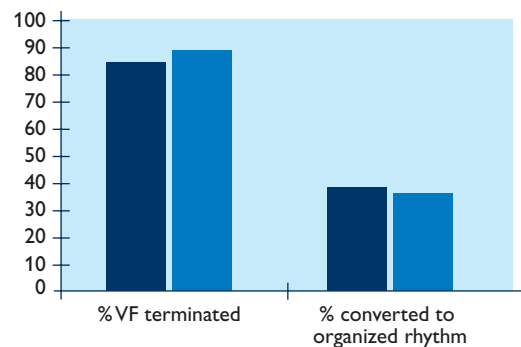
Results

When comparing the Physio-Control fixed low energy protocol patients with Physio-Control escalating high energy, there are no significant differences in results for the 51% of patients requiring only one shock.

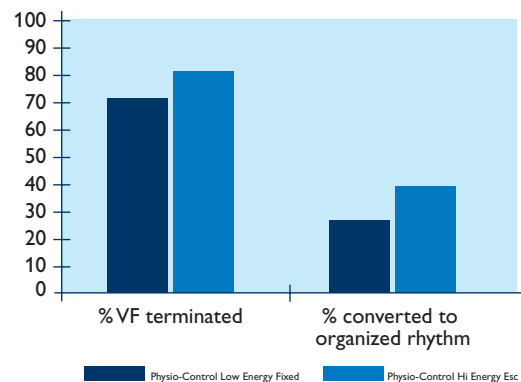
For patients needing more than one shock, VF termination and conversion to organized rhythm was more successful with the Physio-Control escalating high energy than it was with the Physio-Control fixed low energy protocol.

Overall, however, there were no significant differences between the therapy regimens in terms of return of circulation, resuscitation, survival, or neurological outcome.

Efficacy Among Patients Needing One Shock



Efficacy Among Patients Needing Multiple Shocks



Conclusions

The authors concluded that an escalating high energy protocol (200/300/360J) is more effective at defibrillation than one of fixed low energy (150/150/150J) for patients that require multiple shocks. However, the authors found no difference in clinical outcomes between these protocols.

Philips Commentary

While the study's conclusions may apply to the Physio-Control waveform, they cannot be generalized to other commercially available defibrillator technologies. In fact, they are contradicted by a separate clinical study of a more prevalent 150J waveform, the Philips SMART Biphasic.¹ That study observed high efficacy for patients needing multiple shocks. There is no significant degradation in efficacy for patients requiring multiple shocks. This would suggest that when a waveform is sufficiently potent from the start, there is no need to escalate further. The resuscitation benefits of this Philips low energy therapy have been demonstrated in animal studies² and human studies.^{1,3}

Biphasic therapies from different manufacturers are different. It is not valid to generalize results of one manufacturer's therapy to another, even at the same energy level.

The Stiell study states that "...patients in ventricular fibrillation benefit from higher biphasic energy levels..." However, the study does not compare high energy with *commonly used* lower energy technologies. The commercially common⁴ Philips 150J low energy technology has *high peak current*. The Physio-Control 150J therapy studied here has comparatively *low peak current* (note that Physio-Control nowhere recommends its therapy at 150J for treatment of VF). Thus, the study compares a manufacturer-recommended high energy therapy to

that same manufacturer's non-recommended low energy/*low peak current*, and not to the more prevalent Philips low energy/*high peak current* therapy. It is not surprising that the Physio-Control fixed 150J therapy did not perform as well.

Current defibrillates, not energy.^{5,6} Within safety limits, the higher the peak current, the better the defibrillation success.² Philips 150J SMART Biphasic therapy has 41% higher peak current than that of the 150J Physio-Control therapy used in this study,⁷ making the Philips therapy more potent. The Stiell study implies that the low current Physio-Control waveform is comparable to higher current designs, giving the impression that all waveforms of a given joule setting are equally potent. They are not.

The most the study's authors can legitimately conclude is that a *Physio-Control* 150J therapy protocol fixed at low peak current is less effective than a *Physio-Control* therapy that eventually escalates to sufficiently high peak current.

As ECRI corroborates: "...the optimal energy level for biphasic defibrillators will [likely] vary with the units' waveform characteristics...a waveform designed for low energy defibrillation may result in an overdose if applied at high energies, while another waveform designed for high energy may not defibrillate at lower energies."⁸

References

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- ⁵ *Circulation*. 2005; 112:IV-41.
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- ⁷ HeartStart FR2 Series Defibrillator Technical Reference Manual, Edition 3. P3-10.
- ⁸ *Health Devices*. June 2001; 30(6):219.



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