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EDITORIAL

Emergency Medical Services

Finding the right pace: Addressing the transition from manual to mechanical compression devices for out-of-hospital cardiac arrest

Survival rates after an out-of-hospital cardiac arrest remain low despite notable advances in out-of-hospital care. The 1-year global survival rates are ≈7.7% and increase to 12.6% among patients receiving bystander cardiopulmonary resuscitation (CPR).[1] Early initiation of effective compressions with minimal interruptions is essential to maximizing favorable outcomes after out-of-hospital cardiac arrest. Yet effective compressions are subject to a provider's ability to maintain an accurate compression rate, compression depth, and chest recoil allowance. In addition, a provider delivering manual compressions eliminates his or her ability to participate in alternative resuscitation efforts.

During the past several decades, mechanical CPR devices have been deployed to improve the quality of compressions delivered. Mechanical compression devices such as the LUCAS alleviate the limitations of manual compressions by serving as an additional "mechanical resource" capable of providing optimized compressions. In resource-limited areas with limited providers or extended emergency medical services transportation times, these mechanical devices are useful in maximizing resuscitative efforts. However, evidence for the superiority over manual compressions is lacking.[2] A 2016 meta-analysis found no difference in survivability between mechanical and manual CPR.[3]

Few studies to date have assessed an important nuance of mechanical chest compression devices—the delicate and difficult transition from manual to mechanical compression devices. This elapsed time includes positioning the patient on the compression device backplate, connecting the compression device to the backplate (and often challenging task for new users), adjusting the device for accurate compression location, and digitally starting the device. In total, this could result in a significant delay and cessation of perfusion. Prior research has noted that this transition can result in chest compression pauses of up to 35 seconds.[4] Are these delays harmful? Prior studies have demonstrated worse outcomes with the use of mechanical compressions devices.[5] In the AutoPulse Assisted Prehospital International Resuscitation trial, application of the auto-pulse devices resulted in almost 2 minutes of chest compression interruption, potentially explaining the lower out-of-hospital cardiac arrest survival seen associated with mechanical chest compressions in that trial. This paradox presents an important conundrum; any survival benefit from a mechanical chest compression device could be easily undone by the slow application of the device. To date, no rigorous randomized controlled trial has definitively shown the superiority of mechanical CPR—could the manual-to-mechanical transition be the smoking gun?

In the study by Levy et al,[6] titled "Metrics of Mechanical Chest Compression Device Use in Out-of-Hospital Cardiac Arrest," the researchers give us hope for the future use of mechanical chest compressions. The authors specifically focused on time to implementation of mechanical CPR as well as the transition time from standard (manual) to mechanical CPR. In this retrospective analysis comparing survivability among 49 patients with out-of-hospital cardiac arrest (ventricular tachycardia/ventricular fibrillation) receiving manual CPR alone versus a combined manual and mechanical CPR, the authors reported a median duration of 6.9 minutes before the transition to a mechanical CPR device. As a result of emergency medical services policy, mechanical CPR could not be initiated sooner than 2 cycles of manual CPR, which prevented earlier initiation. Importantly, the authors reported that the transition from manual to mechanical CPR could be accomplished with impressively minimal interruption (median, 7 seconds; interquartile range, 5–13 seconds). The maximum duration of interruption for any reason was 14 seconds in the manual + mechanical CPR group compared with 10 seconds in the manual compression group. These researchers should be congratulated on their demonstration that practical training on the transition from manual to mechanical CPR can result in a reduced time to implementation (<10 seconds) that could efficiently be completed during a CPR pulse check.

There are several other practical yet important lessons to be taken from Levy et al when considering implementing the use of mechanical compression devices during resuscitation. Although the timing of the transition from manual to mechanical compressions is crucial, the steps required to perform that transition in a successful manner that will impact patient outcomes are even more important. One must take into consideration the training, as well as the cost to provide such training, required to familiarize one's team with how to make this transition in a choreographed manner. This requires specific planning with defining of roles for each person involved in the resuscitation. This

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has implications as adding in the device can complicate already chaotic scenarios; however, as Levy et al have demonstrated, if done correctly, can lead to smoother transitions, ultimately leading to more available resources (ie, frees providers from performing manual compressions) to help deliver care needed.

Per the American Heart Association, every effort should be made to minimize the interruptions in high-quality chest compressions to improve the likelihood of return of spontaneous circulation. Given the successful demonstration of a rapid transition between manual and mechanical CPR by Levy et al, we second the author's conclusion that encourages future research comparing manual to mechanical compressions that employ similar transition training to minimize compression interruption. At this time, further research is still needed to determine whether this limited compression interruption can result in improved survival rates in out-of-hospital cardiac arrest or merely a benefit to those providing manual CPR efforts. Nevertheless, training programs similar to those employed by the Anchorage Fire Department should be encouraged to optimize the transition from manual to mechanical CPR. In addition, the use of mechanical CPR in resource-limited efforts with prolonged transportation time should still be promoted as a means to support emergency medical services out-of-hospital care.

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