Release velocity improvement with a new metronome-guided chest compression protocol: preliminary results of the RITMICO study

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Funding Acknowledgements: Type of funding sources: Foundation. Main funding source(s): Swiss Heart Foundation

Introduction: Annually, emergency medical services treat over 350,000 out-of-hospital cardiac arrests in the U.S. and over 250,000 in Europe. Outcomes vary widely, according also to the quality of the CardioPulmonary Resuscitation (CPR) provided. Recently, it was demonstrated how, on top of the compression phase, chest release phase is also important to obtain an adequate heart and brain perfusion. However, no studies describe how to ameliorate this parameter during resuscitation.

Purpose: We investigated if a modified metronome-guided procedure might improve chest compression release velocity during CPR simulation on standard manikin, compared to the standard procedure.

Methods: We developed a double-click metronome for CPR: the first click corresponds to chest compression and the second to the end of chest release. Volunteers with different levels of expertise in CPR and with a valid BLS-D certification have been included in the study. Each subject performed two CPR manikin simulations following a 4-min protocol with the standard and the modified metronome (Figure 1), in a random order. An Automated External Defibrillator (AED) equipped with pads allowed continuous measurement of CPR quality during simulations. Three CPR parameters have been measured: compression depth, rate and release velocity. CPR simulation was guided only by the external metronome, all audio prompts from the AED were silenced. The two procedures have been compared, in terms of CPR quality, using Wilcoxon signed-ranks test. Impact of subject-specific factors on the difference in CPR quality has been evaluated using stepwise regression.

Results: 151 volunteers were included in the study, 23 of them have been excluded due to incomplete data recording. Comparison between the two procedures (Figure 2) showed a significant increase of median chest compression depth (p<0.001) and release velocity (p<0.05) with the modified metronome. Percentage of compressions within the optimal range was significantly higher for compression depth (p<0.05) and significantly lower for compression rate (p<0.01) with the modified metronome. Chest compression release velocity difference was not statistically significant (p=0.20). No significant impact of sex, age and level of expertise was observed.

Conclusions: The double-click metronome significantly increased CPR quality in terms of both compression depth and release velocity. The decrease of compressions within the optimal rate range in the modified procedure could be due to lack of familiarity with the new rhythm and needs further evaluation. Our study represents the first trial trying to improve chest compression release velocity. Demonstrating the efficacy of this procedure could pave the way to clinical trials in real resuscitations to confirm the potential impact on the outcome of out-of-hospital cardiac arrest.
Study protocol

Comparison between the two procedures

Comparison between standard and modified metronome-guided procedures