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Letter to the Editor

# Improving survival from mechanical chest compression resuscitation

*Dear Editor*

It was with great interest that we read the study by Azeli et al. on mechanical chest compression related injuries and survival.[1] The authors found that high positive and negative compression force variations correlated with diminished survival to hospital admission compared to low compression force (16.7% vs 36.6%; $p = 0.105$).[1]

To our experience mechanical devices allow high-quality chest compressions to be maintained during prolonged CPR. The striking advantage of mechanical devices is that chest compressions can be performed without decline in frequency or compression depth from an exhausted rescuer. Whereas manual compression is followed by passive release from sternal recoil, LUCAS™ is the only automated device that provides additional active decompression to bring LUCAS™ compression full circle. The resulting high volume of ejected blood is associated with improved cerebral and coronary perfusion pressure.[2] Out-of-hospital, mechanical chest compression is particularly valuable in difficult rescue situations with fire brigade using a turntable ladder and during prolonged transport from the back country.[3] In-hospital, the use of mechanical devices has become a routine matter in the operation theatre during extracorporeal cardiopulmonary resuscitation (ECPR) and in the catheterisation laboratory when performing percutaneous coronary intervention (PCI) during cardiac arrest.[4]

However, there is no evidence that overall CPR survival improves with mechanical chest compression compared to manual chest compression CPR.[5] Indeed, one could expect that increased coronary perfusion pressure from mechanical chest compression comes with a higher frequency of return of spontaneous circulation (ROSC).[3] Maintaining venous return to the heart by decreasing intrathoracic pressure during the LUCAS™ decompression phase should be associated with additionally enhanced cardiac output. Presumably, failure to increase the overall survival rate may be associated with reduced thoracic diameter from initial manual compression and with fractures and parenchymal injuries from instantaneous and rough compression as well as from shear forces during active LUCAS™ decompression. Hypothetically, slowing down the second halves of the compression and the decompression phases should help diminish injuries. We assume that the high volume of ejected blood with mechanical devices may justify diminishing the compression rate to approximately 70 per minute. This would allocate more time to reduce the second half of the compression phase by 20% and the second half of the decompression phase by 40% in order to come full circle. This prolonged decompression phase should be associated with fewer injuries and improved coronary blood flow, thus potentially increasing survival from mechanical chest compression resuscitation. However, to support this hypothesis additional clinical and experimental studies are needed.

## Competing interests

No known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Author contributions statement

W.L. contributed in writing and conceptualization of the original draft; D.S. contributed to review & editing and literature research; M.B. contributed in critical review, commentary and interpretation.

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## REFERENCES

1. Azeli Y, Barbería E, Fernández A, García-Vilana S, Bardají A, Hardig BM. Chest wall mechanics during mechanical chest compression and its relationship to CPR-related injuries and survival. Resuscitation Plus 2022;10:100242. https://doi.org/10.1016/j.resplu.2022.100242.
2. Rubertsson S, Karlsten R. Increased cortical cerebral blood flow with LUCAS; a new device for mechanical chest compressions compared to standard external compressions during experimental cardiopulmonary resuscitation. Resuscitation 2005;65:357–63. https://doi.org/10.1016/j.resuscitation.2004.12.006.
3. Schwaiger D, Zanvettor A, Neumayr A, Baubin MA. Add-on-LUCAS2™-Reanimation am NEF Innsbruck [Add-on-LUCAS2™

resuscitation at NEF Innsbruck]. Anaesthesist 2022. https://doi.org/10.1007/s00101-022-01112-z.
4. Wagner H, Madsen Hardig B, Steen S, Sjoberg T, Harnek J, Olivecrona GK. Evaluation of coronary blood flow velocity during cardiac arrest with circulation maintained through mechanical chest compressions in a porcine model. BMC Cardiovasc Disord 2011;11:73. https://doi.org/10.1186/1471-2261-11-73.
5. Gaessler H, Kurka L, Rauch S, Seewald S, Kulla M, Fischer M. Mechanical chest compression devices under special circumstances. Resuscitation 2022. https://doi.org/10.1016/j.resuscitation.2022.06.014.

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