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Letter to the Editor

Reply to: Improving survival from mechanical chest compression resuscitation

Dear Editor

We are very grateful for the comments of Wolfgang Lederer et al. regarding our article "Chest wall mechanics during mechanical chest compression and its relationship to cardio-pulmonary resuscitation (CPR) related injuries and survival" and for giving us the opportunity to reply.[1–2] Compressions performed with the LUCAS™ mechanical compressor (Stryker/Jolife AB, Lund, Sweden) meet the requirements of high-quality CPR, but in large randomised clinical trials that have been conducted so far it has not been shown to improve survival.[3] Therefore, it requires a new approach.

Injuries caused by CPR are an independent factor to poor survival.[4] Our study highlights the need to maintain the elastic properties of the thorax during CPR.[5] Wolfgang Lederer and co-workers note that chest moulding, secondary to CPR-related injuries, negatively affects survival and they hypothesize that slowing down the compression and decompression phases may prevent such injuries. In a review, two studies have found that faster release velocities during chest compression were associated with better survival outcomes.[6] A randomized study has also shown that active decompression up to 30 mm above the sternal resting position did not result in increased CPR injuries compared to standard active decompression.[7] Therefore, slowing the decompression phase might not be beneficial, but it should be evaluated.

In regards of slowing down the chest compression phase could decrease the risk of fractures, some bone damage theoretical models point in this direction, but they have a limited application in CPR biomechanics.[8] Slowing down the compression velocity without modifying the compression depth will not change the peak compression force, and, in our opinion, the compression force and consequently the compression depth, is one of the main injury factors. Therefore, awaiting more information on the matter, it is possible that decreasing only the compression velocity in the suggested range has an insufficient protective effect.

In our study, a relationship between heart size and the incidence of CPR-related injuries is demonstrated for the first time, highlighting the importance of the two main forces present during chest compression: the elastic force of the chest wall and the damping force of the intrathoracic viscera. The influence of the heart on CPR biomechanics depends on its size and unique position in the human thorax, which opens up a promising field of study towards constructing better models that simulate haemodynamic during CPR. In addition to the classic factors associated with CPR injuries, the geometry of the thorax and the location of the compression point need to be taken into account if we want to improve the elasticity of the thorax and the performance of the sternal hinge during CPR.[9,10]

We have put together a multidisciplinary study group aimed at building new predictive models and generating highly reliable simulation models that will move us towards more personalized chest compressions.

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